Conceptual Design Report

Kerr-McGee Chemical LLC
Kress Creek/West Branch DuPage River
DuPage County, IL

October 2002

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

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Respectfully submitted,

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1. Introduction

1.1 General

This document has been prepared by Blasland, Bouck & Lee, Inc., (BBL) and Sevenson Environmental Services, Inc. (SES), on behalf of Kerr-McGee Chemical LLC (Kerr-McGee) and presents the conceptual design report for the Kress Creek/West Branch DuPage River Site (Site) located in DuPage County, Illinois (Figure 1-1). Prior to excavation of each reach of the site, separate detailed engineering designs will be prepared.

This report focuses on the proposed remedial approach for the removal and subsequent management of sediment and floodplain materials that exceed the cleanup criterion (i.e., 7.2 picoCuries per gram [pCi/g] total radium) at the Site. The extent of impacted materials was identified via a 6-year investigation that included walk-over surface gamma radiation surveys and a delineation drilling program with downhole logging as guided by the *Investigation Work Plan for the Kress Creek/West Branch DuPage River Site* (Bono Consulting, July 1999). This investigation was conducted between 1997 and 2002, and is summarized in the *Characterization Report for the Kress Creek/West Branch DuPage River Site* (ProSource Technologies, October 2002).

1.2 Purpose and Report Organization

The purpose of this document is to present the conceptual design for removal and disposal of sediment and floodplain materials that exceed the cleanup criterion at the Site. The conceptual design has been prepared on a reach-specific basis. As described in Section 2, seven reaches were designated for the Site. Section 2 also presents information related to the results of previous and recent investigations conducted at the Site. Section 3 describes general construction-related activities that would be performed in association with remediation conducted at the Site. Section 4 describes the reach-specific remedial approach developed for the seven Site reaches. Specifically, this section includes a description of the remedial approach, an excavation plan, a description of supporting technologies, and a preliminary schedule and cost. Section 5 discusses materials handling considerations. Conceptual restoration approaches are discussed in detail in the *Conceptual Restoration Design Plan* (BBL, October 2002) for the Kress Creek/West Branch DuPage River Site.

2. Available Information Review and Reach Description

2.1 General

The information used to prepare this document includes various documents/drawings that summarize information previously gathered by Kerr-McGee, and observations made by BBL and SES personnel during a Site Familiarization Study performed between February 18 and February 21, 2002. As part of the Site Familiarization Study, BBL and SES personnel performed visual surveys of the river, creek, and surrounding properties, to gather information for use in the preparation of the conceptual design. During the study, observations were made regarding habitat types, potential lay down and haul road locations, access, constructability concerns, reach locations, etc. The following areas were surveyed during the site visit:

- Kress Creek was surveyed on foot from the storm sewer outfall to the confluence with the West Branch DuPage River;
- the West Branch DuPage River and its banks were surveyed by boat from Gary's Mill Road to the Cenacle; and
- large portions of the West Branch DuPage River between the Cenacle and Warrenville Dam and the immediate vicinity of the Sewage Treatment Plant (STP) outfall were surveyed on foot from various vehicular access points.

This information was used to define the reaches and reach-specific remedial approaches contained in this document.

BBL gathered additional information from the STP and DuPage County to be used in the development of a hydraulic model for the conceptual design. The results of the hydraulic model have been incorporated into this document and are described in greater detail in Appendix A.

The remainder of this section provides a summary of the information provided by Kerr-McGee and a description of the reaches defined during the Site Familiarization Study.

2.2 Information Provided by Kerr-McGee

In 1997, Kerr-McGee initiated a delineation of the Site using gamma-walkover surveys and gamma logging of drilled/pounded boreholes. This investigation was completed in 2002 and the information was subsequently used to define the extent of the sediment and floodplain soils that either test above or below 7.2 pCi/g, the cleanup criterion at the Site (ProSource Technologies, October 2002). Floodplain/bank soil and sediment with total radium levels greater than (>) 7.2 pCi/g were identified. Results of the gamma survey generally indicated the presence of an overburden layer throughout the confines of the Site. The areal extent and total depth of material to be removed were provided by Kerr-McGee in an ArcView file and database. The areal extent of material targeted for removal at the Site is illustrated on Figure 1-1.

Certain low activity subsurface material slightly exceeding the cleanup criterion has been agreed to be left in place on certain parcels of municipally-owned property. These areas are discussed in the Characterization Report (ProSource Technologies, Inc., October 2002), but are not shown in Figure 1-1 for reasons of clarity.

In addition to this information, Kerr-McGee provided information on land use and sensitive resources of the areas adjacent to Kress Creek and the West Branch DuPage River in the following documents:

- Draft Wetland Investigation Report for Kress Creek Riparian Corridor prepared by Graef, Anhalt, Schloemer & Associates, Inc. (GAS), August 1998;
- Draft Wetland Investigation Report for West Branch DuPage River Riparian Corridor prepared by GAS, August 2000; and
- Large Tree Inventory Report for Kress Creek and West Branch DuPage River prepared by Roy F. Weston, Inc. (Weston), March 2000.

2.3 Description of Reaches

As shown on Figure 1-1, the Site consists of six miles of creek and river, and various adjacent tracts of land that include residences, property owned by religious organizations, community parks, a county forest preserve, and land belonging to local government Agencies. The Site is located in DuPage County, Illinois, from immediately south of Roosevelt Road and east of the STP in the City of West Chicago to the City of Warrenville along the western border of the Roy C. Blackwell Forest Preserve.

To facilitate the development of the conceptual design, the Site was segmented into seven reaches based on physical characteristics and extent of the material subject to removal. The Site reaches used in this evaluation are designated as follows:

- Reach 1 –Outfall to May Street (Kress Creek);
- Reach 2 – May Street to Joy Road (Gunness Lake on Kress Creek);
- Reach 3 – Joy Road to Route 59 (Kress Creek);
- Reach 4 – Route 59 to Confluence (Kress Creek);
- Reach 5 – STP Outfall to Williams Road (West Branch DuPage River);
- Reach 6 – Williams Road to Butterfield Road (West Branch DuPage River); and
- Reach 7 – Butterfield Road to Warrenville Dam (West Branch DuPage River).

The extent of each Site reach and its associated removal areas are designated on Figure 1-1.

Reach 1 is approximately 800 feet long and extends from the storm sewer outfall to the culvert at May Street within Kress Creek. The Elgin Joliet and Eastern (EJ&E) Railway is located immediately west of the upstream portion of this reach. The land type in this reach is residential and the floodplain/bank area is predominantly covered with common tree species. Removal in this area extends across nearly all of the creek bed and into the floodplain beyond both banks.

Reach 2 is approximately 1,000 feet long and extends along Kress Creek from the culvert at May Street to the culvert at Joy Road. This portion of the creek also is referred to as Gunness Lake. Land type in this reach is residential and the bank area has several trees, predominantly along the eastern bank. This reach traverses several residential properties in close proximity to residential structures. Removal in this area extends across the creek bed and into the floodplain on both banks.

Reach 3 is approximately 4,100 feet long and extends along Kress Creek, from the culvert at Joy Road to the Route 59 bridge, and encompasses the Wilson Road bridge. Land type in this reach is predominantly park upstream of Wilson Road and residential downstream of Wilson Road. This reach traverses Manville Oaks Park and the Nichiren Shoshu Temple property. Several species of trees are located in the vicinity of the Wilson Road bridge. Removal in this area is predominantly floodplain/bank material.

Reach 4 is approximately 1,000 feet long and extends along Kress Creek from the Route 59 bridge to its confluence with the West Branch of the DuPage River. Land type along the western bank is residential (adjacent to the Edgewood Walk housing tract) and along the eastern bank is part of the Roy C. Blackwell Forest Preserve. Several tree species line the southern portion of the western bank and the northern portion of the eastern bank. Removal in this reach is almost exclusively floodplain material.

Reach 5 is approximately 16,100 feet long and extends along the West Branch of the DuPage River from the STP outfall to Williams Road. Land use in this reach through Gary's Mill Road is predominantly residential along both banks with the northern portion adjacent to the western bank belonging to the STP. Between Gary's Mill Road and the confluence with Kress Creek, the river traverses the Roy C. Blackwell Forest Preserve. Between the confluence and the Forest View Drive housing tract, land use adjacent to the river is predominantly forest preserve with residential land in the vicinity of Edgewood Walk and north of Mack Road. Continuing downstream from the Forest View Drive housing tract to Williams Road, land type is almost exclusively residential. Tree species line some portion of each bank. Removal in this reach is predominantly floodplain material.

Reach 6 is approximately 3,600 feet long and extends along the West Branch of the DuPage River from the Williams Road bridge to the Butterfield Road bridge. Land use in this reach is solely residential, except along the northern bank in the downstream portion of the reach that is part of the Roy C. Blackwell Forest Preserve. The majority of the property in this reach comprises the Cenacle. Several tree species are located in the vicinity of the Cenacle. Removal in the upstream portion of this reach is predominantly floodplain material, while removal in the downstream portion of this reach is predominantly sediment material.

Reach 7 is approximately 2,300 feet long and extends along the West Branch of the DuPage River from the Butterfield Road bridge to the Warrenville Dam. This reach is essentially comprised of Warrenville Lake and is encompassed by the Warrenville Grove Forest Preserve. Removal in this reach is predominantly sediment material.

3. General Construction-Related Activities

3.1 General

Before initiating and during the execution of removal activities at the Site, several construction-related activities common to all remedial approaches will be performed. Common construction-related activities include, but are not limited to, removal and disposal of vegetation; provisions for site controls and access; obtaining appropriate permits and approvals; identification and protection of utilities; implementation of erosion and sedimentation controls; survey and site layout; establishment of health and safety protocols; environmental monitoring; and verification of removal limits. This section discusses various procedures and activities related to these items that are general in nature. Common material handling techniques are discussed in Section 5. Additional details would be developed as part of detailed design activities.

Other reach-specific details regarding the proposed remedial approach are discussed in Section 4.

3.2 Removal and Disposal of Vegetation

Prior to commencement of construction activities, brush and trees will be removed, as required, to provide access to the removal and work areas. The above-grade materials cleared from the excavation areas will be chipped, shredded, and/or cut for potential subsequent use as landscaping materials or spread in an approved location on-site. The below-grade materials (e.g., tree stumps and roots) cleared as part of the soil removal activities would be cut into appropriately sized pieces (as necessary) so that they can be more easily managed during subsequent disposition activities.

3.3 Site Controls and Access

Temporary site controls will be established prior to the performance of removal activities. Fencing will be placed adjacent to the active reach where removal activities are being performed with warning signs posted at regular intervals along the work area. Temporary site controls will be removed following restoration activities within the active reach.

To restrict access during removal activities, warning tape may be placed at certain locations such as open excavations, cleaning areas, stockpile areas, etc. As indicated above, warning signs may also be posted along the work area. For the duration of removal activities, a sign-in/sign-out sheet will be maintained for the site and all on-site personnel and site visitors will be required to sign-in upon entering the site and sign-out upon leaving.

Staging areas will be used for staging of equipment and materials, stockpiling soil and sediments, cleaning activities, and filtering. All staging areas will be constructed using a high density polyethylene (HDPE) liner, geotextile and stone, and will be bermed around the perimeter for containment. Proposed locations of such work areas are discussed in Section 4.

Access will be necessary from various locations on both sides of the creek and river. Appropriate agreements will need to be obtained in order to access these properties. To provide equipment access to the staging areas, an access road will be placed where an existing road is not available. To provide equipment access to the removal areas, haul roads will be constructed as required. The haul and access roads will be constructed by first clearing vegetation, performing limited grading (if necessary), and placing geotextile (and/or geogrid in soft areas) followed by a layer of gravel (typically eight inches). All main access/haul roads will be approximately 16 feet in width. Anticipated locations of access roads are discussed in Section 4.

Following the completion of the removal activities, the access/haul roads will be removed, unless property owners request otherwise. For conceptual design purposes, it was assumed that a portion of the gravel could be re-used in subsequent reaches and some portion would need to be disposed off-site.

3.4 Permits and Other Approvals

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA - also known as Superfund) regulations exempt work such as this, conducted on-site, from obtaining most permits. United States Environmental Protection Agency (USEPA) approvals will be required for both on- and off-site work. Off-site work is not exempt from permits, and Kerr-McGee would comply with the substantive requirements of other permits for on-site work. Thus, state and/or other local regulatory agencies may require permission for transportation of materials over city, township, county or state streets and roadways, use of a trans-shipment point, and use of private or government lands for material handling and processing. It is anticipated that it will be necessary to meet the substantive permit requirements of: the United States Army Corps of Engineers (USACE) for the in-river removal and fill activities; the Illinois Department of Nuclear Safety; USEPA and/or

Illinois EPA; DuPage County and local municipalities for site activities and transportation of materials; and the Forest Preserve District for site activities. These requirements will be evaluated further as part of detailed design activities.

3.5 Identification and Protection of Utilities

For this project, the utilities anticipated to be encountered during remediation include natural gas, fuel pipelines, water, sewer, communication, cable television lines, and electrical power distribution and stormwater collection/conveyance systems. Prior to the performance of the removal activities, the utilities will need to be identified, reevaluated, and/or protected. At this time, known utilities include water and sanitary sewers at the upstream and downstream ends of Gunness Lake (Reach 2), as well as a high-voltage cable at the upstream end of Emerald Green (Reach 5). Identification and protection of utilities will be evaluated further as part of the detailed design activities; however, implementation of the currently proposed remedial approach is not anticipated to significantly conflict with known utilities. For example, when utilizing sheetpile, the sheetpile will not be placed within utility easements along roadways.

3.6 Erosion and Sedimentation Control

The selection of specific erosion and sedimentation control measures for the removal activities will depend on a number of considerations that include scope of activities, site topography, type of ground cover, whether controls are land- or water-based, and operational/maintenance considerations. In addition to the various physical types of control measures that can be installed, certain operational and management practices will be implemented throughout the project to provide an additional measure of erosion and sedimentation control. This subsection describes some of the fixed controls that will be installed before initiating the intrusive sediment and/or soil removal activities.

Before initiating soil or sediment removal and restoration activities, appropriate erosion control measures will be installed to minimize the potential for rainfall- or flood-induced migration of soils into or out of the areas subject to disturbance. These measures may include the placement of geotextile fencing and/or hay bales along the edge of the creek/river, the sides of the bank, and/or around the sheetpiling/shored areas. The specific locations of these controls will be determined and adjusted in the field, based on site-specific considerations related to drainage, topography, work activities, etc.

The sedimentation and erosion control measures will also include a method to filter water collected from the excavations and staging areas. The filtering process is anticipated to include an influent holding tank, with a pump, and bag filter system.

Additionally, depending on the location, silt curtains, turbidity barriers, sand bag or earthen berms, or sheetpile may be installed in the creek/river to isolate removal areas and limit the potential downstream transport of sediment or soil. The installation of these measures is specific to each reach and is further described in Section 4.

3.7 Survey, Site Layout, and Verification

The initial surveying and site layout activities that were previously performed by Kerr-McGee used a Global Positioning System (GPS) that resulted in the generation of detailed base mapping in support of this project. The detailed mapping identifies the elevation of the surface that marks the boundary between the base of material that is below the cleanup criterion (overburden) and the top of material exceeding the cleanup criterion. The detailed mapping also identifies the elevation of the surface that marks the base of material that exceeds the cleanup criterion (verification surface).

Cut depths to the base of the overburden will be established prior to initiating excavation. During excavation, the progress of the excavation will be monitored by the Contractor using grade stakes, construction levels, etc., to ensure that over excavation does not occur. Post removal, this excavation surface will be verified using GPS techniques to confirm that overburden excavation did not encroach into material exceeding cleanup criterion. The process for radiologically screening removed overburden materials is described in Section 5.2.2.

After the overburden has been removed from an area, material exceeding the cleanup criterion will be excavated to the lower elevation (base) of such material. This final excavation surface also will be verified using GPS surveying techniques to confirm that the agreed upon final verification surface elevation has been attained. Specific verification points will be defined as a means of quality assurance that excavation has attained the agreed upon elevation parameters. Material removed from between the upper (top) and lower (base) elevations of material exceeding the cleanup criterion will be processed in accordance with Section 5.2.3 and shipped to the disposal facility.

The survey activities will be performed and recorded in accordance with GPS surveying protocols that will be developed as part of the detailed design.

3.8 Health and Safety

Detailed descriptions of the health and safety measures that will be taken to protect workers and/or the community will be developed as part of the detailed design. This Health and Safety Plan (HASP) will be used and modified as necessary, in relation to all site preparation, excavation, and restoration activities for this project. For conceptual design purposes, it has been assumed that similar health and safety procedures will be followed in each reach. Where appropriate, contingency plans will be developed specific to each reach. Such contingency plans would include flooding contingency plans to be implemented to reduce the potential for downstream migration of contaminants in the event of flood conditions. Given that pumps are designed for an average maximum monthly flow, and sheetpile and berms are designed for a two-year flow, it is anticipated that there will be instances where overtopping will occur. Potential contingency measures could include removal of water diversion/control structures, placement of geotextile, installation of interior berms, removal of equipment/personnel, temporary covering/protection of exposed excavation areas, and augmentation of downstream sediment control structures.

3.9 Environmental Monitoring

In addition to the health and safety monitoring that will be performed in accordance with the Site HASP, various environmental monitoring activities are also anticipated to be performed. This subsection presents the conceptual water column and air monitoring program that will be performed during removal activities and restoration.

3.9.1 Water Column Monitoring

The objective of the proposed water column monitoring activities is to identify, evaluate, and respond to potential water column impacts that may result from the soil and sediment removal activities. Water column monitoring activities will be performed at an upstream and downstream location within the creek/river immediately adjacent to the active removal area during removal activities (as appropriate). Water column samples from these locations will be measured for turbidity.

Water column monitoring will begin once the first intrusive removal activities are initiated and will continue for the duration of the removal and restoration activities within the creek/river. During active removal or restoration activities, water column monitoring may be conducted using automated sampling equipment to reduce labor requirements. Samples will be collected hourly and composited (on a volume-weighted basis) for a single, daily composite sample. Sample results obtained on a given day will be evaluated collectively at the end of each day. The evaluation of the potential water column impacts during the ongoing removal activities will be primarily based on the turbidity results. The proposed action levels for the turbidity results will be developed during detailed design, based on performance of a baseline study.

In the event that the downstream turbidity action level is exceeded, a number of site assessment activities will be initiated including, but not limited to, the following:

- Review of the ongoing removal activities and modification of the condition/performance of the existing erosion and sedimentation control measures;
- Re-sampling at the downstream location to determine if the prior sampling result was an anomaly or if the elevated reading was possibly a short duration event; and
- Collection of additional samples from various locations within or adjacent to the removal area to possibly identify the potential source(s) of the elevated reading.

If the elevated downstream turbidity is determined to be related to specific removal or replacement activities or site controls, the pertinent activities will be modified to the extent feasible or additional controls will be implemented.

3.9.2 Community Air Monitoring

The details of the community air monitoring activities will be developed in the detailed design. The air monitoring program will consist of particulate sampling within the work area (which includes the removal reach and laydown areas) and at a background location so that changes can be made to work practices and dust control measures can be implemented, if necessary. Personal air monitors (PAMs) will not be utilized. For purposes of conceptual design, it has been assumed that similar air monitoring activities will be performed for each reach.

3.9.3 Dust Control

It is anticipated that the removed material in its native state will be very wet to saturated and that dust control will only be required if dry pockets of soil are excavated. A major dewatering/drying effort will be undertaken such that the saturated excavated material meets shipping requirements. Therefore, no water is anticipated to be added for dust control during drying, overburden layout, or loading. Only minimal water use is anticipated during excavation. No dust control measures will be required for site preparation activities in clean areas, for site restoration activities, or haul road maintenance.

Dust control measures will be implemented if air monitoring detects radioactivity above the action thresholds or if Occupational Safety and Health Administration (OSHA) limits are exceeded. The OSHA personal exposure limit for nuisance dust is 15 milligrams per cubic meter (mg/m^3). Dust control measures will be used where appropriate during excavation and handling of removed material exceeding the cleanup criterion. Small amounts of visual dust will not be cause for implementation of dust control activities. Dust control measures will be used where appropriate during the excavation activities at the Site.

3.10 Winter Shut Down

As it is anticipated that completion of removal throughout the Site will require more than one construction season, winter shut down may be required. For purposes of this conceptual design, it is conservatively assumed that removal activities will cease during January, February, and March of each construction year. In reality, shut down will be dependent on weather conditions (e.g., precipitation, temperature) encountered each season. Whenever practicable, construction activities will be performed year round.

In the event winter shut down is necessary, equipment will be "winterized" and remain on site as appropriate. Site controls (as described in this section) will be maintained, and appropriate erosion and sedimentation control measures will remain in place as warranted. Appropriate safety measures will be implemented to mitigate potential hazards associated with temporary stoppage of work.

3.11 Community Relations Plan

To ensure that the individuals, local groups, and businesses potentially impacted by implementation of the removal activities are adequately informed and involved, a community relations plan will be developed and carried out.

Conceptually, the following activities will be considered for inclusion/discussion in the community relations plan:

- Public notification (e.g., newspaper notice) of significant events;
- Public meetings when required or desirable;
- Fact sheets to summarize project status and announce major milestones or upcoming events;
- Door-to-door outreach to inform neighboring property owners of activities and to solicit input;
- Project mailing/contact list (including neighboring property owners, local officials [town and county contacts], Agency representatives, political representatives, relevant businesses or organizations, and certain media outlets [e.g., local newspapers]) for distribution of fact sheets or other information;
- Information repository (local libraries and/or internet-based) to house relevant documents for public access;
- A telephone information line with recorded message;
- Access agreements with property owners; and
- Meetings with property owners to discuss proposed remediation and restoration on that property.

4. Description of Reach-Specific Remedial Approaches

4.1 General

The following subsections provide reach-specific discussions of the proposed removal methods to be employed for each of the seven reaches identified in Section 2, including a description of the removal activities, an excavation plan, a description of supporting technologies, anticipated duration and preliminary cost. The approximate locations of the various components of the removal approaches are provided on Figures 4-1 through 4-7. The overall preliminary construction schedule is presented on Figure 4-8.

The remedial approaches described herein were developed based on consideration of site-specific knowledge, related experience at other sites and the results of site-specific modeling conducted as described in Appendix A. As described in further detail in Appendix A, site-specific modeling was used to predict potential for flooding and other impacts due to placement of water diversion structures, as well as estimate velocities to aid in channel restoration design. The 2-year return flow was simulated to provide an estimated diversion structure height. The 25-year return flow was simulated to evaluate increased flooding potential in upstream areas as well as a result of structure placement. Bypass pumps were sized based on an average maximum monthly flow observed throughout a one-year period.

It should be noted that components of these conceptual remedial approaches will be refined during the detailed design phase with appropriate pre-design investigations performed to further understand site conditions (e.g., geotechnical conditions to address potential issues with sheetpile installation, groundwater infiltration) and process option performance (e.g., construction water filtering, dewatering).

4.2 Development of Remedial Approach

The remedial approach developed for each reach was based on information provided by Kerr-McGee regarding Site characteristics and observations made during the Site Familiarization Study as discussed in Section 2. For each reach, the following components were considered in the development of the proposed remedial approach:

- technical feasibility/constructability;

- safety and associated risks (e.g., safety of workers, residents, infrastructure);
- material handling/staging (e.g., materials separation, radiological screening, stabilization, volume reduction);
- development of access/haul roads and staging areas;
- water diversion (e.g., pump bypass, sheetpile flow diversion, sand bags, berms);
- flood impacts (via assessment of hydraulic modeling results);
- type of solids containment (e.g., turbidity barrier, silt curtain, sheetpile);
- dewatering/filtering technologies;
- method of excavation;
- relative costs; and
- potential schedule impacts.

An assessment of disposal options was not performed as part of this evaluation. It was assumed that all materials designated for off-site disposal will be brought to a transfer station for subsequent disposition.

From a general perspective, the remedial approach for each reach was developed to minimize impacts to residential properties and the community, avoid desirable tree species and wetland areas (thereby minimizing impact to the natural environment), take advantage of existing roads and topography for safe site ingress and egress, minimize the potential for flooding, and restrict the potential for removed materials to be redeposited at new locations. Equipment to be utilized for removal was limited in several reaches as typical water depths preclude use of floatable "in-river" equipment. Further considerations, specific to the development of the remedial approach within each reach, are discussed in each subsection below.

4.2.1 Calculation of Reach-Specific Volumes

To facilitate development of the remedial approach, reach-specific removal volumes were developed using the database information provided by Kerr-McGee. Volumes within each reach were estimated for both floodplain soil and sediment considering both materials that test above and below the cleanup criterion. Total surface areas were determined for each reach by summing surface areas for all removal areas (as shown on Figure 1-1) within a specific reach. Volumes were calculated using the average depth of either material that exceeds the cleanup criterion or material that is below the cleanup criterion provided for all boreholes within each polygon and multiplying by the total surface area associated with each polygon. Volumes were further separated by sediment or floodplain based on the percent of total surface for each reach that exists within or outside of the creek/river boundary. A summary of these volume estimates is presented in Table 4-1.

4.2.2 Cost Estimate Preparation

Based on the conceptual remedial approaches presented herein, preliminary cost estimates for implementing each remedial approach have been developed at a level appropriate to a conceptual design. A combination of experience at other similar sites, best professional judgment, and an understanding of the Site developed through consideration of existing information and performance of the Site Familiarization Study have been applied to the preparation of these preliminary cost estimates. The preliminary costs only reflect estimated costs for the remedial approach for Reaches 1 through 7 of the Site. The preliminary cost estimates include engineering design, construction, restoration, and monitoring at the Site.

Most, if not all, of the individual components that have been assembled into the remedial alternatives have been utilized in some fashion at similar remediation sites, to varying degrees of success. The ability to predict the performance and associated cost of a particular aspect of an alternative varies widely, sometimes because of, or in spite of, this extensive experience base. Variability in performance can be directly related to elements, such as the inability to directly observe removal effectiveness in submerged situations, while other sources of variance stem from the uncertainty in the behavior of control structures such as silt curtains or turbidity barriers in a highly variable environment like a flowing stream.

Certain aspects of the variability, and subsequent uncertainty, in the estimation of the costs of a particular remedial alternative can be captured in one of two ways - either by the addition of a reasonable contingency factor to the overall cost estimate, or by making conservative assumptions about certain parameters related to the components where uncertainty is greatest. Both approaches are typically used at a conceptual design level, and have been employed in the development of the cost estimates presented in this report. During the preparation of the detailed design for a project, various investigations and studies can be undertaken to reduce the uncertainty from both sources of cost variability.

The preliminary costs do not include, among other costs, costs associated with any remediation of upland areas of the STP or at McDowell Dam. The requirements for remediation, if any, at the upland areas of the STP or at McDowell Dam have not been determined.

4.3 Reach 1 - Outfall to May Street (Kress Creek)

Reach 1 includes the stretch of Kress Creek between the storm sewer outfall and May Street (as described in Section 2). A total of approximately 8,450 cy, comprised of both sediments and bank/floodplain materials that either test above or below the cleanup criterion, are targeted for removal from this reach, with the majority of the areal extent of the creek bed targeted for removal (specific volume breakdown provided in Table 4-1). Water depths are fairly shallow (e.g., 1 to 3 feet) indicating that dewatering the reach should be manageable. The creek bed is generally comprised of rocky material and larger-sized debris. Removal within the upstream portion of the western floodplain extends to the toe of the EJ&E Railway embankment. In addition, the storm sewer outfall and culvert located beneath the EJ&E Railway discharge into the upstream portion of this reach. The downstream portion of this reach traverses two residential properties located on May Street. Prospective groundwater infiltration must also be considered, given the depth of the water table in this reach.

Water depths in this reach preclude the use of hydraulic dredging or other floatable "in-river" equipment for removal of creek materials. The areal extent of necessary floodplain removal, in conjunction with the existing topography, make excavation with overlying water in place impracticable. Outfall/culvert inflows must be appropriately diverted to maintain conveyance and not compromise removal operations. Stability of the embankment adjacent to the EJ&E Railway must also be maintained. In consideration of this information, the proposed remedial approach developed for Reach 1 is excavation performed through the use of dewatering, including sheetpile near the railroad/outfall area and pump bypass.

This remedial approach is described in detail below and the approximate locations of the various components of the removal approach are provided on Figure 4-1.

4.3.1 Description of Remedial Approach (Reach 1)

Excavation of materials will be performed through the use of dewatering including steel sheetpile and a pump bypass system (approximate sheetpile location provided on Figure 4-1). Sheetpile will be placed in three locations to promote dewatering (via flow diversion and minimization of groundwater infiltration) and stability. Specifically, sheetpile will be installed around the box culvert located in the northwest corner of the reach adjacent to the EJ&E railroad tracks to "box in" the flow from this outfall and provide a set up location for bypass pumping equipment. A separate pumping system would be installed to divert flow from the storm sewer outfall to the main bypass pumping system set up at the railroad tracks. In addition, slope stability at the base of the railroad track embankment will be established through the installation of approximately 300 feet of sheetpile from the storm sewer outfall extending south. Sheetpile will also be installed around the entire northern portion of the removal area to enclose the deep excavation area on the northeast side of the creek to allow dewatering to be performed and prevent slope failure in this area. It is anticipated that the sheetpile will not be placed in the immediate vicinity of any homes within the reach. It is assumed that 40-foot length sheetpiling with tieback anchors at the railroad tracks will be utilized. Although it is not possible to eliminate water in the excavation area, use of sheetpile or similar techniques will make the excavation manageable.

A sand bag berm will be constructed to restrict flow from the secondary culvert located beneath the railroad tracks in the middle portion of the reach. In addition, a silt curtain will be placed by the downstream end of the reach to mitigate migration of suspended solids and provide additional protection against flooding.

The pump bypass system is expected to include four 12-inch pumps located at the box culvert in the northwest corner of the reach adjacent to the railroad tracks. Three of the pumps will be used for continuous pumping, with one pump on standby in case of pump failure. The bypass pumping setup in Reach 1 will also be utilized for excavation activities in Reach 2. These pumps will discharge water through pipelines to a discharge point located immediately downstream of the box culvert at Joy Road.

A main dewatering sump using a pump installed in the base of the excavation will be utilized to transport water from the deep excavation area (surrounded by sheetpile) in preparation for removal activities and to maintain manageable conditions during excavation. During excavation, dewatering sumps will also be set up as needed to assist in dewatering the removal areas, with the water transferred to the main dewatering sump. Water collected with the main dewatering sump will be pumped to a temporary sedimentation and erosion control area for filtering. Water will be discharged at Joy Road.

One soil staging area will be constructed in this reach with the area divided into separate portions for both creek bed and bank sediments that are above or below the cleanup criterion. The staging area will be located outside of the excavation area adjacent to the northeast portion of the reach on privately-owned property (as shown on Figure 4-1). Use of the property as a staging area has been assumed to be a negotiable issue. This staging area location was selected in an attempt to avoid wetlands, desirable trees species, and floodway limits. This location will allow Roosevelt Road to be used by the haul vehicles transporting soils that exceed the cleanup criterion from the staging area to the disposal transfer station. The staging area will be constructed as described in

Sections 3 and 5. All residual water from the staging area will be filtered at the temporary sedimentation and erosion control area for filtering and subsequently discharged at Joy Road.

4.3.2 Excavation Plan (Reach 1)

Once the bypass pumping system has been established and the reach dewatered, the excavation dewatering sump system will be installed. The sumps will be used to keep the reach dewatered during excavation operations by pumping accumulated water to the temporary sedimentation and erosion control area for filtering.

Following dewatering sump system installation, two haul roads will be constructed. A main haul road will be constructed along the east side of the creek and a second haul road will be constructed along the west side of the creek (approximate road locations provided on Figure 4-1). Each road will be placed outside the creek bed, but within the excavation limits, and will serve as the main access for the excavation work. An access road will be constructed from the staging area to Roosevelt Road for haul vehicles to transport materials to the transfer station. In addition, water crossings will be installed for equipment to cross the creek, as necessary. These roads and crossings will be constructed as described in Section 3.

Excavation of the targeted areas will begin at the upstream end of the reach and continue downstream until all targeted materials are removed. The overburden materials will be removed first, followed by material that exceeds the cleanup criterion. Removal operations will be performed using an excavator and an adequate number of off-road haul trucks to allow for continuous removal. It is estimated that overburden sediment and floodplain materials will be excavated at a rate of 400 cubic yards per day (cy/day). Sediment and floodplain soils that exceed the cleanup criterion will be excavated at a rate of 200 cy/day and 400 cy/day, respectively.

Excavated overburden material will be placed on the staging area and staged for testing as described in Section 5. If such material is confirmed to be below the cleanup criterion, it will be removed from the pad for staging in an open area adjacent to the pad until it is returned to the excavation. If the material does not satisfy the cleanup criterion, it will be transferred to the section of the staging area containing material that exceeds the cleanup criterion in preparation for loading to the transfer station. The overburden excavation operations will proceed downstream until all overburden is believed to be removed.

In a similar manner, other material will be hauled to the section of the staging area that contains material that exceeds the cleanup criterion where it will be allowed to gravity dewater and stabilized using quicklime (approximately 15% by weight), as necessary, in order to meet paint filter and moisture content requirements for disposal. It is assumed that bank and floodplain soils will not require stabilization to meet paint filter and moisture content requirements.

All materials requiring off-site disposal will be loaded at the staging area with a backhoe into dump trucks for transport to the disposal transfer station. Excavated materials that, after testing in accordance with Section 5, are determined to not exceed the cleanup criterion (i.e., 7.2 pCi/g) will be used as backfill.

After completion of the removal and restoration activities, the west haul road will be excavated. Clean stone will be salvaged for reuse as appropriate, and the remainder of the material transported with the material that exceeds the cleanup criterion to the transfer station. Excavation activities in Reach 2 will be performed in combination with Reach 1 activities. Therefore, the eastern haul and access roads and staging area will be left in place for use during excavation activities within Reach 2. All road materials will be radiologically screened prior to disposal/reuse. Note, as part of restoration, haul roads could be left in place for use as walking trails for local residents. The bypass pumping system will be left in place during restoration activities and all activities within Reach 2 (as described below in Section 4.4).

4.3.3 Supporting Technologies (Reach 1)

As previously described, in order to keep the excavation area dewatered during removal activities, a series of sumps will be installed. Water collected from the sumps will be transferred to the temporary sedimentation and erosion control area for filtering prior to discharge.

The temporary sedimentation and erosion control area for filtering will consist of an influent holding tank, a pump, and a bag filter system. Water will be pumped from the soil staging area and excavation area to the temporary sedimentation and erosion control area for filtering prior to discharge. All water will be discharged downstream of the Joy Road box culvert.

Additional detail on supporting technologies and materials handling is discussed in Section 5.

4.3.4 Restoration (Reach 1)

The creek banks and floodplains will be backfilled to the final subgrades and restored as described in the Conceptual Restoration Design Plan (BBL, October 2002). Materials being returned to the excavation will contain a combination of material excavated from the creek banks and bed stored at the staging area, as well as imported fill material. The material will be placed in the backfill areas, compacted, and graded using a backhoe or bulldozer, depending on the presence of water and the grading work required.

All disturbed wetlands on the creek banks and surrounding areas will be backfilled to finished grades with a planting soil and planted in accordance with the restoration plan. Similarly, all other disturbed areas (including the staging area, haul and access roads, and temporary sedimentation and erosion control area for filtering) will be backfilled to finished grades and appropriately revegetated.

4.3.5 Duration (Reach 1)

The total time to setup, perform the excavation, and restore this reach is approximately 12.5 weeks, weather dependent.

4.3.6 Preliminary Cost Estimate (Reach 1)

The preliminary estimated cost for this remedial approach is $7.0 million. Implementation of this alternative is expected to generate approximately 10,200 tons of material for disposal (including removed materials, access/haul roads, staging area materials, etc.). A summary of the preliminary costs by reach is provided in Table 4-2.

4.4 Reach 2 – May Street to Joy Road (Gunness Lake on Kress Creek)

Reach 2 includes the stretch of Kress Creek referred to as Gunness Lake between May Street and Joy Road (as described in Section 2). A total of approximately 9,430 cy, comprised of both sediment and floodplain materials that either test above or below the cleanup criterion, are targeted for removal from this reach (specific volume breakdown provided in Table 4-1). The majority of the areal extent of the lake is targeted for removal in this reach. The creek traverses several residential properties, with some structures located in close proximity to areas targeted for floodplain removal. Additionally, there is a deep excavation area (i.e., 7 feet) located in the northwest portion of the lake. Groundwater infiltration in this reach must also be considered given the depth of the water table.

As this reach solely traverses residential land and is in close proximity to several structures, development of temporary haul roads in this reach were located within the removal limits. Furthermore, the staging area constructed for excavation in Reach 1 will be utilized during construction in this reach to minimize disturbance to property and residents along this reach. Stability of the soil must be maintained in the deep excavation area in the northwest portion of the lake. The proposed removal approach developed for Reach 2 is excavation performed through the use of dewatering, including sheetpile around the northwest lake area and pump bypass. Based on modeling efforts (further described in Appendix A), placement of sheetpile will have no appreciable impact on flood stage.

This remedial approach is described in detail below, and the approximate locations of the various components of the removal approach are provided on Figure 4-2.

4.4.1 Description of Remedial Approach (Reach 2)

Excavation of materials will be performed through the use of dewatering including steel sheetpile and a pump bypass system (approximate sheetpile location provided on Figure 4-2). Sheetpile will be placed around the deep excavation area located at the northwest corner of Gunness Lake to allow dewatering for excavation and maintain slope stability. It is assumed that 40-foot length sheetpiling will be utilized. A silt curtain will be placed by the downstream end of the reach to mitigate migration of suspended solids and provide additional protection during flooding. Although it is not possible to eliminate water in the excavation area, use of sheetpile or similar techniques will make the excavation manageable.

The bypass pumping system used for Reach 1 will be extended through Reach 2 to a discharge point downstream of the Joy Road culvert. To mitigate infiltration of groundwater from Reach 1, a sand bag berm will be installed at the upstream end of Reach 2 to contain the water.

A main dewatering sump using a pump installed in the base of the excavation will also be utilized to transport water from the deep excavation area in the northwest corner of the lake (surrounded by sheetpile) in preparation for removal activities and to maintain manageable conditions during excavation. During excavation, dewatering sumps will also be set up as needed to assist in dewatering the removal areas with the water transferred to the main dewatering sump. Water collected with the main dewatering sump will be pumped to the temporary sedimentation and erosion control area for filtering. Water will be discharged at Joy Road.

The staging area constructed in the northeast portion of Reach 1 will be used to stage and load creek bed and bank sediments excavated from Reach 2. The use of this staging area will prevent the construction of additional staging areas on private properties located within Reach 2, and will allow Roosevelt Road to be used by the haul vehicles transporting soils that exceed the cleanup criterion to the disposal transfer station. All residual water from the staging area will be filtered at the sedimentation and erosion control area for filtering and subsequently discharged at Joy Road.

4.4.2 Excavation Plan (Reach 2)

Once the bypass pumping system has been extended and Reach 2 dewatered, the excavation dewatering sump system (as described in Reach 1) will be used to keep the area dewatered during excavation operations by pumping accumulated water to the temporary sedimentation and erosion control area for filtering.

Following dewatering sump system installation, a main haul road (see Figure 4-2) will be constructed down the middle of the lake within the excavation limits. In addition, up to ten “finger” roads will be constructed perpendicular to the main haul road within the excavation limits. The main road and ten finger roads will serve as the main access for the excavation work. These roads will be constructed as described in Section 3. In addition, the haul road constructed for use during Reach 1 removal activities will be left in place and used to transport materials from Reach 2 to the staging area located within Reach 1.

Excavation of the targeted areas will begin at the upstream end of the reach and continue downstream until all targeted materials are removed. The overburden materials will be removed first, followed by materials that exceed the cleanup criterion. Removal operations will be performed using an excavator and an adequate number of off-road haul trucks to allow for continuous removal. It is estimated that overburden materials will be excavated at a rate of 400 cy/day. Sediment and bank soils that exceed the cleanup criterion will be excavated at an estimated rate of 200 cy/day and 400 cy/day, respectively.

Excavated overburden material will be placed on the staging area located in Reach 1 and staged for testing (as described in Section 5). If such material is confirmed to be below the cleanup criterion, it will be removed from the pad for staging in an open area adjacent to the staging area until it is returned to the excavation. If the material does not satisfy the cleanup criterion, it will be transferred to the section of the staging area containing material that exceeds the cleanup criterion. The overburden excavation operations will proceed downstream until all overburden is removed.

In a similar manner, other material will be hauled to the section of the staging area containing material that exceeds the cleanup criterion where it will be allowed to gravity dewater and stabilized using quicklime (approximately 15% by weight), as necessary, in order to meet paint filter and moisture content requirements for disposal. It is assumed that bank and floodplain soils will not require stabilization to meet paint filter and moisture content requirements.

All materials requiring off-site disposal will be loaded at the staging area with a backhoe into dump trucks for transport to the disposal transfer station. Excavated materials that, after testing in accordance with Section 5, are determined to not exceed the cleanup criterion (i.e., 7.2 pCi/g) will be used as backfill.

After the completion of removal activities, the haul and access roads in Reaches 1 and 2 will be excavated. All road materials will be radiologically screened prior to disposal/reuse, therefore it is assumed that a portion of stone from these roads will be salvaged for reuse as appropriate, with the remainder excavated and transported with the material that exceeds the cleanup criterion. Similarly, the staging area will be excavated, tested and hauled in the same manner as other material.

The bypass pumping system will be left in place until restoration activities are completed. Once restoration has been completed, the entire bypass pumping system will be removed from Reaches 1 and 2.

4.4.3 Supporting Technologies (Reach 2)

As previously described, in order to keep the excavation area dewatered during removal activities, a series of sumps will be installed. Water collected from the sumps will be transferred to a temporary sedimentation and erosion control area for filtering prior to discharge.

The temporary sedimentation and erosion control area for filtering will consist of an influent holding tank, a pump, and a bag filter system. Water will be pumped from the soil staging area and the excavation area to a temporary sedimentation and erosion control area for filtering prior to discharge. All filtered water will be discharged downstream of the Joy Road box culvert.

Additional detail regarding these supporting technologies and materials handling techniques are discussed in Section 5.

4.4.4 Restoration (Reach 2)

The creek banks and floodplains will be backfilled to the final subgrades and restored as described in the Conceptual Restoration Design Plan (BBL, October 2002). Materials being returned to the excavation will contain a combination of material excavated from the creek banks and bed stored at the staging area and imported clean fill material. The material will be placed in the backfill areas, compacted, and graded using a backhoe or bulldozer, depending on the presence of water and the grading work required.

All disturbed wetlands on the creek banks and surrounding areas will be backfilled to finished grades with a planting soil and planted in accordance with the restoration plan. Similarly, all other disturbed areas (including the staging area, haul and access roads, and temporary sedimentation and erosion control area for filtering) will be backfilled to finished grades and appropriately revegetated.

4.4.5 Implementation Schedule (Reach 2)

The total time to setup, perform the excavation, and restore this reach is approximately 13.5 weeks, weather dependent.

4.4.6 Preliminary Cost Estimates (Reach 2)

The preliminary estimated cost for this remedial approach is $7.0 million. Implementation of this alternative is expected to generate approximately 10,900 tons of material for disposal (including removed materials, access/haul roads, staging area materials, etc.). A summary of the preliminary costs by reach is provided in Table 4-2.

4.5 Reach 3 – Joy Road to Route 59 (Kress Creek)

Reach 3 includes the stretch of Kress Creek between Joy Road and Route 59 (as described in Section 2). A total of approximately 8,080 cy, comprised predominantly of bank/floodplain material, is targeted for removal from this reach (specific volume breakdown provided in Table 4-1). The majority of the material targeted for removal in this reach is located within the floodplain, with a limited amount of removal extending into the creek bed. Water depths in this reach are shallow (1 to 2 feet). Upstream of Wilson Road the creek traverses Manville Oaks Park, an area with several acres of open land. Downstream of Wilson Road, the creek traverses property designated as residential land use including the Nichiren Shoshu Temple along the eastern floodplain.

Given the extent of removal within the reach (e.g., predominantly floodplain versus sediment material), excavation would occur utilizing equipment located on shore. Access areas and haul roads will be located as to avoid impacting properties along the creek. For instance, along the downstream portion of the reach, haul roads will be developed along the western shore to avoid/minimize disturbance to the Nichiren Shoshu Temple property. Infiltration of groundwater within this reach is expected to be manageable. Given these considerations, the proposed remedial approach developed for Reach 3 is excavation performed through the use of dewatering, including use of berms and pump bypass. It is anticipated that the use of berms will be effective in minimizing infiltration, which will facilitate manageable excavation of the limited amount of sediment thereby improving accuracy of removal activities. Also, in the event of flooding within this reach, work will be performed in smaller increments which would limit the area potentially affected by a flood event.

This remedial approach is described in detail below and the approximate locations of the various components of the removal approach are illustrated on Figures 4-3A and 4-3B.

4.5.1 Description of Remedial Approach (Reach 3)

Excavation of materials will be performed through the use of dewatering including a series of seven pump bypass systems spanning approximately 750 feet each. Excavation operations will proceed from upstream to downstream in the reach with each segment being completed in its entirety (excavation and restoration) before moving the bypass pumping system downstream to the next targeted area.

To prepare the first segment within this reach for bypass pumping, an earthen berm will be constructed at the upstream and downstream ends of the 750-foot segment to isolate it. A polyethylene sheet will be placed over the berms and secured with sand bags, as necessary. The pump bypass system is expected to include four 12-inch pumps placed at the upstream berm. Three of the pumps will be used for continuous pumping with one on standby in case of pump failure. The pumps will discharge the water through pipelines to the discharge point located beyond the downstream berm.

A main dewatering sump using a pump installed in the base of the excavation will be utilized to transport water from the enclosed segment in preparation for excavation activities, and also used to keep the area dewatered during excavation. During excavation operations, dewatering sumps will also be set up as needed to assist in dewatering the removal areas, with the water transferred to the main dewatering sump. Waters collected with the main dewatering sump will be pumped to the temporary sedimentation and erosion control area for filtering. Filtered water will be discharged downstream of the downstream berm.

Two soil staging areas will be constructed in this reach away from residences and the temple. One staging area will be located outside of the excavation area south of Joy Road on the east side of the creek as shown on Figure 4-3A. The second staging area will be located outside of the excavation area north of Route 59 on the west side of the creek as shown on Figure 4-3B. Both locations will allow Joliet Street to be used by the haul vehicles transporting soils that exceed the cleanup criterion from the staging area to the disposal transfer station. The staging area locations were also selected in an attempt to avoid wetland areas, desirable tree species, and floodway limits. The staging areas will be constructed as described in Sections 3 and 5. All residual water from the staging area will be filtered and subsequently discharged at Route 59.

4.5.2 Excavation Plan (Reach 3)

Once the bypass pumping system has been establish and the area dewatered, the excavation dewatering sump system will be installed. The sumps will be used to keep the area dewatered during excavation operations by pumping accumulated water to the temporary sedimentation and erosion control area for filtering.

Excavation in this reach will require the construction of two haul roads. One haul road will be constructed between Joy Road and Wilson Road along the east side of the creek outside the creek bed and excavation limits. The second haul road will be placed along west side of creek between Joy Road and Route 59 as shown on Figures 4-3A and 4-3B. Up to six creek water crossings will be installed for equipment to cross the creek. Access roads will be constructed from each of the staging areas to Joliet Road for haul vehicles to transport materials to the disposal transfer station. All roads and crossings will be constructed as described in Section 3.

Excavation of the overburden material will begin at the upstream end of the reach working downstream, in each segment enclosed by the berms, through continuous use of excavators and off-road haul trucks. Excavated material will be placed on the staging area and staged for testing. If such material is confirmed to be below the cleanup criterion, it will be removed from the pad for staging in an open area adjacent to the staging area until it is returned to the excavation. If the material does not satisfy the cleanup criterion, it will be transferred to the section of the staging pad that contains material that exceeds the cleanup criterion in preparation for loading to the off-site disposal location. The overburden excavation operations will proceed downstream until all overburden is believed to be removed in each enclosed segment.

In a similar manner, excavation of other material will begin upstream in each segment and move downstream using excavators and off-road haul trucks. This material will be hauled to the section of the staging area that contains material that exceeds the cleanup criterion where it will be allowed to gravity dewater and stabilized using quicklime (approximately 15% by weight), as necessary, in order to meet paint filter and moisture content requirements for disposal. It is assumed that bank and floodplain soils will not require stabilization to meet paint filter and moisture content requirements.

Once removal of materials is complete within each bermed segment, restoration activities will be performed prior to movement of the pump bypass system to the next downstream area. Once the restoration is completed, the pumps and upstream berm of the bypass pumping system will be removed and installed at the next 750-foot area, and the downstream berm will be used as the upstream berm for the new segment. This scenario will continue down the creek until Reach 3 is completed.

It is estimated that overburden sediments and floodplain soil will be removed at a rate of 400 cy/day, creek sediments that exceed the cleanup criterion will be removed at a rate of 200 cy/day, and floodplain soil that exceeds the cleanup criterion will be removed at a rate of 600 cy/day in this reach (given the open space available for maneuvering).

All materials requiring off-site disposal will be loaded at the staging area with a backhoe into dump trucks for transport to the disposal transfer station. Excavated materials that, after testing in accordance with Section 5, are determined to not exceed the cleanup criterion (i.e., 7.2 pCi/g) will be used as backfill.

Once excavation and restoration operations are complete, the staging areas and haul and access roads will be removed. It is assumed that some portion of the material from the roads will be salvaged for reuse since the roads will be located outside of the excavation area. All staging area materials and any other materials determined to be not salvageable will be transported to the transfer station for appropriate disposal. All road materials will be radiologically screened prior to disposal/reuse.

4.5.3 Supporting Technologies (Reach 3)

Small sumps will be constructed and placed within the excavation areas as necessary to transport the water to a temporary sedimentation and erosion control area for filtering.

The temporary sedimentation and erosion control area for filtering will consist of an influent holding tank, a pump, and a bag filter system. Water will be pumped from the soil staging area and the excavation areas to the temporary sedimentation and erosion control area for filtering prior to discharge. All filtered water from Reach 3 will be discharged beyond the downstream berm in each bypass pumping setup.

Additional detail regarding these supporting technologies and materials handling techniques are discussed in Section 5.

4.5.4 Restoration (Reach 3)

The creek banks and floodplains will be backfilled to the final subgrades and restored as specified in the Conceptual Restoration Design Plan (BBL, October 2002). Materials being returned to the excavation will contain a combination of material excavated from the reach and imported fill material. The material will be placed in the backfill areas, compacted, and graded using a backhoe or bulldozer, depending on the presence of water and the grading work required.

All disturbed wetlands on the creek banks and surrounding areas will be backfilled to finished grades with a planting soil and planted in accordance with the restoration plan. Similarly, all other disturbed areas (including the staging areas, haul and access roads, and temporary sedimentation and erosion control area for filtering) will be backfilled to finished grades and appropriately revegetated.

4.5.5 Implementation Schedule (Reach 3)

The total time to setup, perform the excavation, and restore this reach is approximately 8 weeks, weather dependent.

4.5.6 Preliminary Cost Estimate (Reach 3)

The preliminary estimated cost for this remedial approach is $5.9 million. Implementation of this alternative is expected to generate approximately 11,000 tons of material for disposal (including removed materials, access/haul roads, staging area materials, etc.). A summary of the preliminary costs by reach is provided in Table 4-2.

4.6 Reach 4 – Route 59 to Confluence (Kress Creek)

Reach 4 includes the stretch of Kress Creek between Route 59 and the confluence (as described in Section 2). A total of approximately 3,650 cy, comprised almost exclusively of bank/floodplain material, is targeted for removal from this reach (specific volume breakdown provided in Table 4-1). The majority of the material targeted for removal in this reach is located within the floodplain, with a limited amount of removal extending into the creek bed. Water depths in this reach are shallow (approximately 1 foot). Land use in the western floodplain of this reach is residential, while land within the eastern floodplain is part of the Roy C. Blackwell Forest Preserve.

Given the extent of removal within the reach (e.g., predominantly floodplain versus sediment material), excavation would occur utilizing equipment located on shore. Access areas and haul roads will be located as to avoid impacting properties located along the creek. Given the extent of removal within both floodplains, development of haul roads along both sides of the creek can not be avoided, however necessary staging areas within this reach would be located within the Forest Preserve property rather than within the Edgewood Walk housing tract. Infiltration of groundwater within this reach is expected to be manageable. Given these considerations, the proposed remedial approach developed for Reach 4 is excavation performed through the use of dewatering, with berms at Route 59/confluence and pump bypass.

This remedial approach is described in detail below and the approximate locations of the various components of the removal approach are provided on Figure 4-4.

4.6.1 Description of Remedial Approach (Reach 4)

Excavation of materials will be performed through the use of dewatering, including a bypass pumping system spanning the entire reach. To set up for bypass pumping, an earthen berm will be constructed at the upstream and downstream ends of the reach. A polyethylene sheet will be placed over the berms and secured with sand bags, as necessary.

The bypass pump system is expected to include four 12-inch pumps placed at the upstream berm. Three of the pumps will be used for continuous pumping with one on standby in case of pump failure. The pumps will discharge the water through pipelines to the discharge point located beyond the confluence.

A main dewatering sump using a pump installed in the base of the excavation will be utilized to transport water from the reach in preparation for excavation activities, and also used to keep the area dewatered during excavation. During excavation operations, dewatering sumps will also be set up as needed to assist in dewatering the removal areas, with the water transferred to the main dewatering sump. Water collected with the main dewatering sump will be pumped to the temporary sedimentation and erosion control area for filtering prior to discharge at the confluence.

One soil staging area will be constructed in this reach. The staging area will be located outside of the excavation limits just south of Route 59 on the east side of the creek (as shown on Figure 4-4). This location will allow Route 59 to be used by the haul vehicles transporting soils that exceed the cleanup criterion from the staging area to the disposal transfer station. Also, the staging area location was selected in an attempt to avoid area houses, wetlands, desirable trees species, and floodway limits. The staging area will be constructed as described in Sections 3 and 5. All residual water from the staging area will be filtered and subsequently discharged at the confluence.

4.6.2 Excavation Plan (Reach 4)

Once the bypass pumping system has been put in place and the area dewatered, the excavation dewatering sump system will be installed. The sumps will be used to keep the area dewatered during excavation operations by pumping accumulated water to the temporary sedimentation and erosion control area for filtering.

Excavation in this reach will require the construction of two haul roads. Each haul road will be constructed along the entire length of the reach between Route 59 and the confluence with one adjacent to the east side of the creek and the other adjacent to the west side, both outside the creek bed and excavation limits. In addition, water crossings will be installed as necessary. All roads will be constructed as described in Section 3.

Excavation of the overburden material will begin at the upstream end of the reach working downstream through continuous use of excavators and off-road haul trucks. Excavated material will be placed on the staging area and staged for testing. If such material is confirmed to be below the cleanup criterion, it will be removed from the pad for staging in an open area adjacent to the pad until it is returned to the excavation. If the material does not satisfy the cleanup criterion, it will be transferred to the section of the staging area containing material that exceeds the cleanup criterion in preparation for loading to the off-site disposal location. The overburden excavation operations will proceed downstream until all overburden is believed to be removed from the reach.

In a similar manner, excavation of other material will begin upstream and move downstream using excavators and off-road haul trucks. Material will be hauled to the section of the staging area containing material that exceeds the cleanup criterion where it will be allowed to gravity dewater and stabilized using quicklime (approximately 15% by weight), as necessary, in order to meet paint filter and moisture content requirements for disposal. It is assumed that bank and floodplain soils will not require stabilization to meet paint filter and moisture content requirements. Excavation of material will proceed downstream until completion of the reach. Upon completion of excavation, the staging area will be excavated and disposed. The bypass pump system and haul roads will be left in place until backfill operations have been completed. Once backfilling has been completed, the roads will be removed and disposed.

It is estimated that overburden materials will be excavated at a rate of 400 cy/day. Sediment and bank soils that exceed the cleanup criterion will be excavated at a rate of 200 cy/day and 400 cy/day, respectively.

All materials requiring off-site disposal will be loaded at the staging area with a backhoe into dump trucks for transport to the disposal transfer station. Excavated materials that, after testing in accordance with Section 5, are determined to not exceed the cleanup criterion (i.e., 7.2 pCi/g) will be used as backfill.

Once excavation and restoration operations are complete, the haul roads and staging area will be excavated and disposed. It is assumed that some of the stone from the access roads will be salvaged for reuse in other reaches and any stone not salvageable, along with any geotextile and geogrid used to construct the roads, will be disposed. All road materials will be radiologically screened prior to disposal/reuse.

4.6.3 Supporting Technologies (Reach 4)

Small sumps will be constructed and placed within the excavation areas as necessary to transport the water to the main dewatering sump prior to discharge to the temporary sedimentation and erosion control area for filtering.

The temporary sedimentation and erosion control area for filtering will consist of an influent holding tank, a pump, and a bag filter system. Water will be pumped from the soil staging area and the excavation areas to the temporary sedimentation and erosion control area for filtering prior to discharge. The filtered water will be discharged downstream of the confluence. Additional detail regarding these supporting technologies and materials handling techniques are discussed in Section 5.

4.6.4 Restoration (Reach 4)

The creek banks and floodplains will be backfilled to the final subgrades and restored as described in the Conceptual Restoration Design Plan (BBL, October 2002). Materials being returned to the excavation will contain a combination of material excavated from the reach and imported clean fill material. The material will be placed in the backfill areas, compacted, and graded using a backhoe or bulldozer, depending on the presence of water and the grading work required.

All disturbed wetlands on the creek banks and surrounding areas will be backfilled to finished grades with a planting soil and planted in accordance with the restoration plan. Similarly, all other disturbed areas (including the staging areas, haul and access roads, and temporary sedimentation and erosion control area for filtering) will be backfilled to finished grades and appropriately revegetated.

4.6.5 Implementation Schedule (Reach 4)

The total time to setup, perform the excavation, and restore this reach is approximately 5 weeks, weather dependent.

4.6.6 Preliminary Cost Estimate (Reach 4)

The preliminary estimated cost for this remedial approach is $2.8 million. Implementation of this alternative is expected to generate approximately 5,300 tons of material for disposal (including removed materials, access/haul roads, staging area materials, etc.). A summary of the preliminary costs by reach is provided in Table 4-2.

4.7 Reach 5 - STP Outfall to Williams Road (West Branch DuPage River)

Reach 5 includes the stretch of the West Branch DuPage River between the STP outfall and Williams Road (as described in Section 2). A total of approximately 23,180 cy, comprised of both material that either tests above or below the cleanup criterion, is targeted for removal from this reach (specific volume breakdown provided in Table 4-1). The majority of the material targeted for removal in this reach is located within the floodplain, with a limited amount of removal extending into the river. Removal in this reach between the STP outfall and Gary's Mill Road is limited. Downstream of Gary's Mill Road and continuing to the Forest View Drive housing tract, land along both banks of the river is predominantly part of the Roy C. Blackwell Forest Preserve. A deep excavation (i.e., 7 feet) is required along the western bank in the immediate vicinity of the Edgewood Walk housing tract. Stability of the soil in this area must be maintained during excavation. Downstream of the Forest View Drive housing tract, land use is primarily residential with several properties in the immediate vicinity of the floodplain. A floodplain area targeted for removal exists along the base of a relatively steep grade adjacent to the Emerald Green apartment complex. This slope would be stabilized during removal activities in this area. Water depths in this reach are fairly shallow (i.e., < 3 feet).

Given the extent of removal in this reach (e.g., predominantly floodplain versus sediment material), excavation from shore would be favorable, however the density of residences along the downstream portion of this reach and the fact that the upstream portion of the floodplain area targeted for removal would need to be accessed through the Roy C. Blackwell Forest Preserve (with limited existing roads in this reach), utilizing the river bed as a hauling mechanism may be preferred. However, it must be recognized that water depths preclude the use of floatable "in-river" equipment in this reach. Development of necessary haul roads and access area will be limited to non-residential land use where appropriate. There are several smaller areas targeted for removal in this reach between the STP outfall and Gary's Mill Road, as well as in the most downstream portion of this reach. Given the residential nature of these areas, it is desirable to remove these areas selectively utilizing small equipment with limited access through select residential properties. Infiltration of groundwater is not expected to present an issue during removal of materials within this reach. Given these considerations, the proposed remedial approach developed for Reach 5 is excavation performed through the use of dewatering, including use of sheetpile and pump bypass (stretch from the STP outfall to Gary's Mill Road excavated through the use of turbidity barriers). While this approach may incur a higher cost, it offers value as minimal disturbance to the forest preserve would occur. The proposed remedial approach would also provide additional ability to accommodate flooding, as work will be performed in smaller manageable increments which would limit the area that may be affected if a flood event occurred.

This remedial approach is described in detail below and the approximate location of the various components of the removal approach are provided on Figures 4-5A through 4-5E.

4.7.1 Description of Remedial Approach (Reach 5)

Excavation from the STP outfall to Gary's Mill Road will be performed using turbidity barriers or sand bags (to be determined during detailed design) to mitigate migration of resuspended sediment downstream during removal activities. Since the majority of the removal areas are located along the river bank, the turbidity barriers/sand bags will be installed along the river's edge and anchored to the bank. The excavation activities will proceed upstream to downstream in small excavation areas (up to 1,000-foot long work areas) contained by turbidity barriers/sand bags (Figures 4-5A).

The remainder of the reach (i.e., Gary's Mill Road to Williams Road) will be divided into four segments using a pump bypass system to allow excavation to be performed through the use of dewatering in each segment. The four segments include (from upstream to downstream): Gary's Mill Road to the confluence with Kress Creek;

confluence to Mack Road; Mack Road to the River Oaks housing development; and River Oaks housing development to Williams Road (see Figure 4-5B through 4-5E). The pump bypass system and excavation operations will be performed upstream to downstream in the reach with each segment being completed in its entirety (excavation and restoration) before movement of the pump bypass system to the next downstream segment.

In preparation for the first segment for pump bypass, once excavation is completed through Gary's Mill Road, steel sheetpile will be installed across the river just downstream of Gary's Mill Road to isolate this segment. Sheetpile will also be installed at the downstream end of the first segment (just upstream of the confluence).

The pump bypass system is expected to include three 30-inch pumps located at the upstream sheetpile wall. Two of the pumps will be used for continuous pumping with one on standby in case of high flows or pump failure. These pumps will discharge the water to a discharge point located immediately downstream of the downstream sheetpile, through pipelines anchored to the stream bed.

A main dewatering sump using a pump installed in the base of the excavation will be utilized to transport water from the cordoned off segment in preparation for excavation activities, and to keep it dewatered during excavation operations. During excavation operations, dewatering sumps will transfer water to a pump which will also be set up as needed to assist in dewatering the removal areas, with the water transferred to the main dewatering sump. Water collected with the main dewatering sump will be pumped to the temporary sedimentation and erosion control area for filtering prior to discharge downstream of the downstream sheetpile.

A total of five staging areas will be constructed in this reach. Specifically, one staging area will be placed as follows (moving upstream to downstream): slightly south of the STP on the western side of the river (Figure 4-5A); immediately south of Gary's Mill Road on the western side of the river (Figure 4-5B); adjacent to Edgewood Walk on the western side of the river (Figure 4-5C); just south of Mack Road on the western side of the river (Figure 4-5D); and adjacent to the Emerald Green apartment complex on the eastern side of the river (Figure 4-5E). All staging areas will be located outside of the targeted excavation areas with some areas located within the floodplain. As such, the staging areas will be "built up" to avoid any potential consequences of flooding in the area. Access to these staging areas will be achieved through construction of access roads from existing adjacent roads. The staging areas and access roads will be constructed as described in Sections 3 and 5.

4.7.2 Excavation Plan (Reach 5)

Prior to excavation at each bank area upstream of Gary’s Mill Road, turbidity barriers/sand bags will be installed in the river parallel to the bank and attached to the bank at the upstream and downstream ends of the excavation areas. Turbidity barriers/sand bags are intended to mitigate migration of suspended solids during removal operations. All excavation work will proceed upstream to downstream in this section of the reach. Excavation will require the use of primary haul roads generally constructed along the eastern side of the river outside of the excavation limits (Figure 4-5A). Minor access roads will be constructed to provide access to smaller discrete removal areas just upstream of Gary’s Mill Road without disturbing the existing land to the same extent as the primary haul roads. The minor access road will be approximately 8 feet wide and constructed in the same manner as the primary haul roads.

Excavation of the areas downstream of Gary’s Mill Road will begin once the bypass pumping system has been put in place and the area is dewatered. The excavation dewatering sump system will be installed to keep the area dewatered during excavation operations by pumping accumulated water to the temporary sedimentation and erosion control area for filtering. Within each segment, a haul road will be constructed down the middle of the river for access to the excavation areas. This road will be used to transport excavated materials to the staging pad being used for that segment. The roads and crossings will also be installed, as necessary, as described in Section 3.

Steel sheetpile will be installed for stability and to minimize groundwater infiltration at the deep bank excavation area located just south of the confluence and behind the River Oak/Emerald Green housing/apartment complexes, on the west side of the River (Figure 4-5E).

Excavation of the targeted areas will begin at the upstream end of either the area enclosed by the turbidity curtains/sand bags or the sheetpiled area and continue downstream using excavators and an adequate number of off-road haul trucks to allow for continuous removal activities. Removal of the overburden material from each area will be performed first. All excavated overburden will be transported to the nearest staging area, and allowed to gravity dewater for radiological screening. If such materials are confirmed to be below the cleanup criterion, the material will be removed from the pad for staging in an open area adjacent to the pad for return to the excavation. If the material does not satisfy the cleanup criterion, it will be transferred to the side of the staging area containing material that exceeds the cleanup criterion in preparation for loading to the transfer station for off-site disposal. The overburden excavation operations will continue downstream until all overburden has been removed from the bank areas.

In a similar manner, excavation of the other material will begin at the upstream end of the each area and continue downstream. Materials will be hauled to the same area used for the overburden material (i.e., closest staging area) where it will be allowed to gravity dewater and stabilized using quicklime (approximately 15% by weight), as necessary, in order to meet paint filter and moisture content requirements for disposal. It is assumed the floodplain materials will not require stabilization to meet paint filter and moisture content requirements. Materials above the cleanup criterion will be loaded and transported to the transfer station for disposal. Excavation within each enclosed area will be completed as a whole prior to moving to the next downstream area.

It is estimated that overburden materials will be excavated at a rate of 400 cy/day. Sediment that exceeds the cleanup criterion will be excavated at a rate of 100 cy/day and 200 cy/day from areas enclosed by the turbidity curtains/sand bags and berms, respectively. All soils that exceed the cleanup criterion will be removed at a rate of 400 cy/day.

All materials requiring off-site disposal will be loaded at the staging area with a backhoe into dump trucks for transport to the disposal transfer station. Excavated materials that, after testing in accordance with Section 5, are determined to not exceed the cleanup criterion (i.e., 7.2 pCi/g) will be returned to the excavation.

Once excavation operations are complete in an area serviced by a particular staging area, the staging area will be excavated and disposed as appropriate. The haul and access roads will be left in until backfill operations have been completed. As haul roads are removed, it is assumed that since the roads will be located outside of the excavation areas, some of the stone used to construct the roads should be salvageable for reuse in other reaches or disposed. All staging area and any materials determined not salvageable will be transported to the transfer station for appropriate disposal. All road materials will be radiologically screened prior to disposal/reuse.

In addition, restoration activities will be completed prior to moving to the next targeted segment. After the completion of restoration, the turbidity curtain or pump bypass system will be removed and re-installed at the next segment to repeat the process described above. This scenario will be performed along the entire reach until all targeted areas have been addressed.

4.7.3 Supporting Technologies (Reach 5)

Some of the deeper bank cuts upstream of Gary's Mill Road may accumulate ponded contact water from the excavation operations that will require filtering before discharge to the river. As previously described, if necessary, in order to keep the excavation area dewatered for excavation operations, a series of sumps will be installed. In addition, a main dewatering pump will be used in the pump bypass areas. Water collected from the sumps will be transferred to a temporary sedimentation and erosion control area for filtering consisting of an influent holding tank, a pump, and a bag filter system for filtering prior to discharge. Also, water collected at the staging areas will be transported for filtering prior to discharge to the river. Water will be discharged downstream of the targeted excavation area (i.e., downstream of Gary's Mill Road or the downstream sheetpile). Additional detail regarding these supporting technologies and materials handling techniques are discussed in Section 5.

4.7.4 Restoration (Reach 5)

The river banks and floodplain areas will be backfilled to the final subgrades and restored as described in the Conceptual Restoration Design Plan (BBL, October 2002). Materials being returned to the excavation will contain a combination of excavated material and imported clean fill material. The material will be placed in the backfill areas, compacted, and graded using a backhoe or bulldozer, depending on the presence of water and the grading work required.

All disturbed wetlands on the river banks and surrounding areas will be backfilled to finished grades with a planting soil and planted in accordance with the restoration plan. Similarly, all other disturbed areas (including the staging areas, haul and access roads, temporary sedimentation and erosion control area for filtering) will be backfilled to finished grades and appropriately revegetated.

4.7.5 Implementation Schedule (Reach 5)

The total time to setup, perform the excavation, and restore the area is approximately 28.5 weeks, weather dependent.

4.7.6 Preliminary Cost Estimate (Reach 5)

The preliminary estimated cost for this remedial approach is $17.7 million. Implementation of this alternative is expected to generate approximately 22,400 tons of material for disposal (including removed materials, access/haul roads, staging area materials, etc.). A summary of the preliminary costs by reach is provided in Table 4-2.

4.8 Reach 6 – Williams Road to Butterfield Road (West Branch DuPage River)

Reach 6 includes the stretch of the West Branch of the DuPage River between Williams Road and Butterfield Road (as described in Section 2). A total of approximately 4,500 cy, comprised of both sediment and floodplain materials that either test above or below cleanup criterion (removal in the upstream portion of the reach is predominantly floodplain, while removal in the downstream portion is predominantly sediments), is targeted for removal from this reach (specific volume breakdown provided in Table 4-1). Removal within this reach consists of smaller discrete pockets of both floodplain and sediment material. Land use throughout this reach is predominantly residential, with the majority of the property belonging to the Cenacle. A deep removal area has been identified along the northern bank in the vicinity of the Cenacle. This area will be stabilized with sheetpile during removal activities in this area.

Given the location of the areas targeted for removal, excavation activities could occur from the shore or within the river. Water depths in this reach preclude the use of floatable "in-river" equipment for removal activities. Given these considerations, the proposed remedial approach developed for Reach 6 is excavation performed through the use of dewatering, with sheetpile around each removal area (except sand bags for water diversion around smaller west shore and upstream areas).

This remedial approach is described in detail below and the approximate locations of the various components of the removal approach are provided on Figure 4-6.

4.8.1 Description of Remedial Approach (Reach 6)

This remedial approach utilizes two different isolation and excavation technologies – turbidity barriers/sand bags and steel sheetpile. In the upstream part of the reach, there are several shallow bank excavation areas with minimal removal quantities. As such, these areas will be enclosed with turbidity barriers or sand bags, as necessary (to be determined during detailed design). The area adjacent to the Cenacle will be removed using sheetpile for the north bank excavation due to the depth of removal (approximately 7 feet). The removal work downstream of the Cenacle for the larger areas will also be performed through the use of dewatering, including steel sheetpile, and the three small sediment removal areas along the southern shoreline will be cordoned off using turbidity barriers or sand bags. A silt curtain will be placed at the end of the reach to mitigate migration of suspended solids. Although it is not possible to eliminate water in the excavation area, use of sheetpile or similar techniques will make the excavation manageable.

To prepare for excavation in the sheetpiled areas, sheetpile will be installed in the river parallel to the river bank and connecting back to the river bank at both ends allowing excavation operations to be performed through the use of dewatering. Once the sheetpile has been installed, a main dewatering sump using a pump installed in the base of the excavation will be utilized to transport water from the excavation area in preparation for removal activities, and also used to keep the area dewatered during excavation. During excavation, dewatering sumps will also be set up as needed to assist in dewatering the removal areas, with the water transferred to the main dewatering sump. Water collected with the main dewatering sump will be pumped to the temporary sedimentation and erosion control area for filtering prior to discharge downstream of the work area.

Two soil staging areas will be constructed in this reach. One staging area will be located across the river from the Cenacle (on the southern shore) as illustrated on Figure 4-6. The second staging area will be located at the downstream end of the reach on the north bank, just west of Butterfield Road. These two staging areas will be accessed via Batavia Road and Butterfield Road, respectively, for haul vehicles transporting soils that exceed the cleanup criterion from the pad to the disposal transfer station. The staging areas are located outside of the excavation limits and were selected in an attempt to avoid wetland areas and desirable tree species. Since the staging area along the southern shore is located within the floodway limits, this area will be “built up” to avoid potential flooding concerns. The staging areas will be constructed as described in Sections 3 and 5. All residual water from the staging area will be filtered at the temporary sedimentation and erosion control area for filtering and subsequently discharged downstream of Williams Road.

4.8.2 Excavation Plan (Reach 6)

Excavation of small areas located at the most upstream and downstream ends of the reach will be performed through the use of small excavators and haul vehicles. With the use of this equipment, no extensive tree clearing will be required. Minor haul roads (8 feet wide) will be constructed as necessary in a similar manner as the primary haul roads. Excavated material would be transferred to the closest staging area for testing (see Section 5). Restoration of these excavation areas would be performed using the same small excavators and haul vehicles.

Prior to excavation at each area, turbidity barriers/sand bags will be installed in the river parallel to the bank and attached to the bank at the upstream and downstream ends of the excavation areas. Turbidity barriers/sand bags are intended to mitigate migration of suspended solids during removal operations. Excavation in the upstream area will require the use of primary haul roads generally constructed along the river outside of the excavation limits along the north side of the river (Figure 4-6). Minor access roads will be constructed to provide access to smaller discrete downstream removal areas without disturbing the existing land to the same extent as the primary haul roads. The minor access roads will be approximately 8 feet wide and constructed in the same manner as the primary haul roads.

Removal activities for the north and south bank material in the vicinity of the Cenacle would be performed through the use of sheetpile allowing excavation to be performed through the use of dewatering. The haul road will be constructed (see Section 3) along the northern edge of the removal area outside the excavation limits will be utilized. This road will lead to a water crossing that will allow the excavated material to be transferred to the staging area on the south side of the river. The haul road will then extend allow the southern edge of the removal area outside the excavation limit to provide access to the southern shore removal.

Excavation downstream of the Cenacle (along the northern shore) will also be performed through the use of dewatering, including sheetpile as shown on Figure 4-6. A haul road will be constructed for work in this section along the north bank of the river from the most upstream excavation area in the lower reach down to the staging pad adjacent to Butterfield Road. The road will be constructed out of the same materials as provided in Section 3.

Excavation of overburden will begin at the upstream end of each containment system (i.e., turbidity barriers/sand bags or sheetpile) and move downstream using excavators and off-road haul trucks. Excavated material will be placed on the closest staging area, allowed to gravity dewater and staged for testing (see Section 5). If such is confirmed to be below the cleanup criterion, it will be removed from the pad for staging in an open area adjacent to the pad until it is returned to the excavation. If the material does not satisfy the cleanup criterion, it will be transferred to the section of the staging area containing materials that exceed the cleanup criterion in preparation for loading to the off-site disposal location.

In a similar manner, excavation of other material will begin at the upstream end of each containment system and move downstream using excavators and off-road haul trucks. This material will be hauled to the section of the closest staging area containing materials that exceed the cleanup criterion, allowed to gravity dewater and stabilized using quicklime (approximately 15% by weight), as necessary, in order to meet paint filter and moisture content requirements for disposal. It is assumed that bank and floodplain soils will not require stabilization to meet paint filter and moisture content requirements.

It is estimated that overburden materials will be excavated at a rate of 400 cy/day. Sediment and bank soils that exceed the cleanup criterion will be excavated at a rate of 200 cy/day and 400 cy/day, respectively.

All materials requiring off-site disposal will be loaded at the staging area with a backhoe into dump trucks for transport to the disposal transfer station. Excavated materials that, after testing in accordance with Section 5, are determined to not exceed the cleanup criterion (i.e., 7.2 pCi/g) will be used as backfill.

Excavation of the material that exceeds the cleanup criterion will proceed within each area until completion. Once excavation and restoration operations area complete for each area, the staging area and haul roads will be excavated and disposed. Any clean stone from the haul roads will be salvaged for reuse in other reaches and any stone not salvageable, along with any geotextile and geogrid used to construct the roads, will be appropriately disposed. All road materials will be radiologically screened prior to disposal.

4.8.3 Supporting Technologies (Reach 6)

As previously described, in order to keep the excavation areas dewatered for excavation operations, a series of sumps and/or a main dewatering sump will be installed as needed. Water collected from the sumps will be transferred to a temporary sedimentation and erosion control area for filtering prior to discharge.

The temporary sedimentation and erosion control area for filtering will consist of an influent holding tank, a pump, and a bag filter system. Water will be pumped from the soil staging pad and the excavation area to the temporary sedimentation and erosion control area for filtering prior to discharge. Water will be discharged downstream of Butterfield Road. Additional detail regarding these supporting technologies and materials handling techniques are discussed in Section 5.

4.8.4 Restoration (Reach 6)

The river banks and floodplains will be backfilled to the final subgrades and restored as described in the Conceptual Restoration Design Plan (BBL, October 2002). Materials being returned to the excavation will contain a combination of excavated material and imported clean fill material. The material will be placed in the backfill areas, compacted and graded using a backhoe or bulldozer, depending on the presence of water and the grading work required.

All disturbed wetlands on the river banks and surrounding areas will be backfilled to finished grades with a planting soil and planted in accordance with the restoration plan. Similarly, all other disturbed areas (including the staging area, haul and access roads, temporary sedimentation and erosion control area for filtering) will be backfilled to finished grades and appropriately revegetated.

4.8.5 Implementation Schedule (Reach 6)

The total time to setup, perform the excavation, and restore this reach is approximately 12 weeks, weather dependent.

4.8.6 Preliminary Cost Estimate (Reach 6)

The preliminary estimated cost for this remedial approach is $4.7 million. Implementation of this alternative is expected to generate approximately 4,600 tons of material for disposal (including removed materials, access/haul roads, staging area materials, etc.). A summary of the preliminary costs by reach is provided in Table 4-2.

4.9 Reach 7 – Butterfield Road to Warrenville Dam (West Branch DuPage River)

Reach 7 includes the stretch of the West Branch DuPage River referred to as Warrenville Lake between Butterfield Road and the Warrenville Dam (as described in Section 2). A total of approximately 42,120 cy, comprised predominantly of both sediment that tests above or below the cleanup criterion, are targeted for removal from this reach (specific volume breakdown provided in Table 4-1). Removal in this reach predominantly consists of soft sediment material. The lake is encompassed by the Warrenville Grove Forest

Preserve, and a prairie path traverses the most upstream end of this reach. The downstream boundary of the lake is the Warrenville Dam.

Given these considerations, the proposed remedial approach developed for Reach 7 is excavation performed through the use of dewatering, using sheetpile to divert flow. This remedial approach is described in detail below and the approximate locations of the various components of the removal approach are provided on Figure 4-7.

4.9.1 Description of Remedial Approach (Reach 7)

Excavation of materials will be performed through the use of dewatering and steel sheetpile to divert river flow. Consideration must be given to the fact that the flow channels around the two islands are not equal, and therefore may be incapable of accommodating flows if a center sheetpile were to be installed. As such, sheetpile installation will be configured to accommodate the hydraulics of the lake. Although it is not possible to eliminate water in the excavation area, use of sheetpile or similar techniques will make the excavation manageable.

Excavation is anticipated to occur in three sections. Initially the upstream quarter of the lake adjacent to the deep upstream channel will be excavated. As such, sheetpile will be placed to divert flow in an “S curve” through the lake. Once removal is complete and the channel deepened on both sides of the upstream island, sheetpile will be removed and reconfigured to divert flow through half of the lake (the half encompassing the portion initially excavated). Removal will occur in the opposite half of the lake. Sheetpile will then be reconfigured to accommodate removal in the final quadrant of the lake. Performing excavation activities in this manner will allow river flow through the deeper portions of the channel, thereby mitigating scour/flood potential.

Within each removal area, a series of pumps will be installed to pump the water from the targeted excavation side in preparation for removal activities and to keep the area dewatered during excavation operations. These pumps will discharge water downstream of the Warrenville Dam.

In addition to the pumps, additional sumps will be set up as needed to assist in dewatering the removal areas with the water transferred to the main dewatering sump. The sumps will be used to keep the area dewatered during excavation operations. Water collected with the sumps will be pumped to the temporary sedimentation and erosion control area for filtering prior to the discharge point downstream of the Warrenville Dam.

Two soil staging areas will be constructed in this reach. One staging area will be constructed within the Warrenville Grove Forest Preserve along the northern shore adjacent to the downstream end of the largest island as shown on Figure 4-7. An access road will be placed from this staging area to the north to allow Butterfield Road to be used by construction vehicles. The second staging area will be placed along the southern shore approximately half way along the reach as illustrated on Figure 4-7. Access to this staging area will be achieved through the use of Batavia Road. The staging areas and access road will be constructed as described in Sections 3 and 5.

4.9.2 Excavation Plan (Reach 7)

As described above, each portion of the reach will be excavated at a time through the use of sheetpile walls for water diversion. Once the water has been diverted, a dewatering sump system will be installed as necessary within the portion being excavated to keep the area dewatered during excavation operations. The sump system will be used to keep the area dewatered during excavation operations by pumping accumulated water to the temporary sedimentation and erosion control area for filtering. A silt curtain will be installed at the downstream end of the reach to mitigate migration of suspended solids.

Once the sumps have been installed, haul roads will be constructed along the northern shore. An additional haul road will be constructed following sump installation adjacent to the southern shore. In addition, finger roads will be constructed as necessary within each segmented removal area. Minor access roads will be constructed to provide access to smaller discrete removal areas located at the downstream end of the reach without disturbing the existing land to the same extent as the primary haul roads. Also, one small area at the upstream end of the reach will be enclosed with a turbidity barrier and accessed for removal via a minor access road. The minor access roads will be approximately 8 feet wide and constructed in the same manner as the primary haul roads. The approximate location of the haul roads is provided on Figure 4-7, and road construction will be performed as described in Section 3.

Excavation of the targeted areas will begin at the upstream end of the reach and continue downstream using excavators and an adequate number of off-road haul trucks to allow for continuous removal activities. Removal of the overburden material will be performed first. All excavated overburden will be transported to the nearest staging area (i.e., material from northern reach will be hauled to the staging area located to the north, whereas the material removed from the southern side will be hauled to the southern staging area) where it will be allowed to gravity dewater and staged for testing (see Section 5). If such materials are confirmed to be below the cleanup criterion, the material will be removed from the pad for provision to the Forest Preserve District for their use. If the material does not satisfy the cleanup criterion, it will be transferred to the side of the staging area containing materials that exceed the cleanup criterion in preparation for loading to the transfer station for off-site disposal. The overburden excavation operations will continue downstream until all overburden has been removed.

In a similar manner, excavation of other material will begin at the upstream end of the reach and continue downstream until completion. This material will be hauled to either the northern or southern staging area (depending on which side of the reach is being excavated) where it will be allowed to gravity dewater and stabilized using quicklime (approximately 15% by weight), as necessary, in order to meet paint filter and moisture content requirements for disposal. It is assumed the floodplain materials will not require stabilization to meet paint filter and moisture content requirements. Materials above the cleanup criterion will be loaded and transported to the transfer station for disposal. It is estimated that all river bank and floodplain materials will be excavated at a rate of 400 cy/day.

After all removal and restoration activities have been completed in the reach, access roads will be excavated. As appropriate, stone will be salvaged for reuse as appropriate. Otherwise, excavated road material will be hauled to the closest staging area for loading and transport to the disposal transfer station. All road materials will be radiologically screened prior to disposal. Any remaining haul roads and staging areas will be excavated and radiologically screened following removal of the sheetpiling and transported to the disposal transfer station.

4.9.3 Supporting Technologies (Reach 7)

As previously described, a series of sumps will be installed to allow for manageable excavation within both the northern and southern portions of the reach. Water collected from the sumps will be transferred to a main dewatering sump and pumped to the temporary sedimentation and erosion control area for filtering prior to discharge downstream of the Warrenville Dam. Also, water collected at the staging areas will be transported for filtering prior to discharge downstream of the Warrenville Dam. Additional detail regarding these supporting technologies and materials handling techniques are discussed in Section 5.

4.9.4 Restoration (Reach 7)

As each portion of the river excavation is completed, the river banks will be backfilled to the final subgrades and restored as described in the Conceptual Restoration Design Plan (BBL, October 2002). Materials being returned to the excavation will consist of excavated material and imported clean fill material. The material will be placed in the backfill areas, compacted, and graded using a backhoe or bulldozer, depending on the presence of water and the grading work required.

All disturbed wetlands located in the affected floodplain and surrounding areas will be backfilled to finished grades with a planting soil and planted in accordance with the restoration plan. Similarly, all other disturbed areas (including the staging area, haul/access roads, temporary sedimentation and erosion control area for filtering) will be backfilled to finished grades and appropriately revegetated.

Remediation of Reach 7 will generate approximately 15,000 cy of sediment not exceeding the cleanup criterion. This material will be provided to the Forest Preserve District for their use. One potential use may include placing the material in berms above the limits of the 100-year floodplain. The berms would then be revegetated to provide a natural appearance.

4.9.5 Implementation Schedule (Reach 7)

The total time to setup, perform the excavation, and restore the area is approximately 33 weeks, weather dependent.

4.9.6 Preliminary Cost Estimate (Reach 7)

The preliminary estimated cost for this remedial approach is $18.2 million. Implementation of this alternative is expected to generate approximately 39,000 tons of material for disposal (including removed materials, access/haul roads, staging area materials, etc.). A summary of the preliminary costs by reach is provided in Table 4-2.

5. Materials Handling

5.1 General

This section describes the various material handling activities associated with the soil and sediment removal activities at the Site. As bank soils and river sediments are removed, prior to their ultimate disposition, a number of intermediate handling activities must be performed. To ensure that such activities are performed in a manner that minimizes the potential for inadvertent releases of materials that exceed the cleanup criterion to the environment, unsafe conditions for on-site and off-site personnel, and delays or complications in project implementation, several material handling procedures have been identified for those materials (soils, sediments, liquids, and residual wastes) that are expected to be generated during removal activities. In addition, these material handling procedures have been developed to minimize the amount of material generated for regulated disposal. Ultimately, the bank soils and sediments removed during this project will be managed for appropriate re-use or disposition in accordance with applicable regulations.

5.2 Handling of Soils/Sediments

The specific method(s) of handling the removed soils and sediments will be based on, but not limited to, the following considerations:

- The construction and locations of the temporary staging and loading areas;
- The nature of the removed materials (i.e., in relation to the cleanup criterion); and
- Any processes needed to prepare the materials for subsequent disposition (e.g., dewatering of materials containing excessive water).

Each of these considerations is discussed in further detail below.

5.2.1 Location and Construction of Temporary Staging Areas

To minimize the potential for the release of materials that exceed the cleanup criterion materials to the environment during removal and handling activities, it is desirable to minimize the number of times that the material is handled. Therefore, as discussed in Section 4, upon excavation, the soils and sediment will be transported directly to a temporary staging area. The temporary staging areas will function as the sediment/soil loadout area for transport vehicles upon their arrival at the work areas. The temporary staging area will be designed to accommodate a backhoe or front-end loader that will be used to load materials from the temporary staging area into the transport vehicles.

The number and relative size of the staging areas will depend on their proximity to the work areas, and the logistics and rate of the excavation, handling, loading, and transport operations. In general, the staging pads are anticipated to be approximately 200 feet x 200 feet, however a 300 feet x 300 feet staging pad is proposed for Reach 7 due to the volume of material being handled.

The temporary staging areas will be constructed using the following methods and materials:

- To allow for gravity dewatering, the areas to be used to stage the excavated materials will be graded and sloped to a low point to form a collection sump;
- The regraded area will be compacted using a heavy drum roller to form a smooth surface with no protruding objects;
- A berm will be constructed along the perimeter of the regraded and compacted area (the height of the berm may be increased if the staging area is located within the floodplain);
- A thick flexible membrane liner will be installed over the compacted surface or berms; and
- A 2-inch crushed stone layer will be installed over the liner.

Based on current information, it is anticipated that temporary staging areas will be located in the areas discussed in Section 4. Every effort has been made to locate temporary dewatering/staging areas on non-residential-owned properties and in non-wetland areas. In addition, where practical, temporary staging areas have been located outside the floodway and floodplain. Where it is not possible to locate these areas outside of the floodplain, earthen berms will be constructed around the staging areas to protect them from flooding.

Since the materials subject to removal may, upon their initial removal, contain excess water, the temporary dewatering/staging areas will be constructed to facilitate gravity dewatering of these materials. The existing surface topography will be taken into consideration when constructing the temporary dewatering/staging areas (i.e., the temporary dewatering/staging areas will be constructed to allow the excess water to drain to natural low points). Water that accumulates in the low points will be collected using a small submersible pump and handled in accordance with Section 5.3 (Handling of Water). The resulting configuration will allow placement of materials into the temporary dewatering/staging area while minimizing the potential for contact with the underlying surface and the migration of any water released from the materials while present in the dewatering/staging area.

Additional information regarding the use of temporary dewatering/staging areas is as follows:

- Materials transported from the work areas to temporary stockpile areas will be unloaded into the appropriate stockpile based on its designation. Overburden materials will be stockpiled separately from materials that do exceed the cleanup criterion.
- Stockpiled or staged materials will be covered when the area is not actively being used.
- The location of a dewatering/staging area will consider site topography and avoid (to the extent possible) possible rainfall drainage areas.
- To minimize potential erosion and migration issues, the volume of soil/sediment present in a dewatering/staging area will kept at minimum levels.
- Additional erosion and sedimentation control measures (e.g., hay bales, geotextile fencing, etc.) will be utilized as necessary.
- Dewatering/staging areas will be inspected daily and any noted deficiencies will be promptly addressed.

5.2.2 Segregation and Radiological Screening of Overburden Materials

Two categories of materials have been identified: material that is below the cleanup criterion (i.e., less than 7.2 pCi/g); and materials that exceeds the cleanup criterion. When removing materials from a given area containing both categories of material, precautionary measures will be taken to prevent mixing of materials from each classification. These precautions are anticipated to include, but are not limited to, proper excavation sequencing, use of separate stockpile areas, and cleaning equipment prior to initiating excavation in another area.

It is anticipated that immediately post removal, materials will be stockpiled in two categories: overburden; and material that exceeds the cleanup criterion. Following segregation of materials, the overburden material will be radiologically screened to verify radium levels. Radiological screening of materials will be performed at an appropriate interval to determine if the material can be returned to the excavation (i.e., contains radium levels

$\leq$7.2 pCi/g) or whether it will be appropriately disposed with impacted materials (i.e., contains radium levels >7.2 pCi/g).

To perform the screening, a correlation will be established between activity and counts per minute (cpm) to establish the correlation of instrument readings with the activity of the excavated materials. Based on the correlation curve, a threshold reading will be established to allow for field radiological screening and segregation of excavation materials. This correlation will be used by the radiation safety technicians in the field to minimize waste. A NaI(TI) detector will be used in conjunction with a portable scale/rate meter to scan and segregate overburden material at the staging areas.

Excavated overburden material will be placed in the staging area. Following placement at the staging area and dewatering, the material will be spread out in layers not to exceed twelve inches thick. The radiation safety technician will then walk over the material with the NaI(TI) detector to characterize the material. The material will be identified and segregated as satisfying or not satisfying the cleanup criterion. Soil samples will be acquired for laboratory confirmation from all stockpiled types of material on a periodic basis to verify the results of the scanning process. Statistical methods will be developed as part of detailed design and applied to data obtained from segregated and stockpiled materials to assure that materials deemed to be below action levels meet the appropriate criterion.

Overburden materials that do not satisfy the cleanup criterion will be brought to a transfer station for subsequent disposition. Overburden materials that satisfy that cleanup criterion will remain stockpiled at the staging area for return to the excavation or use as fill above the limits of the 100-year flood.

5.2.3 Material Processing

Various material processing steps will be performed. Physical separation and washing of oversize materials is one such step. Based on information gained during the Site Familiarization Study, a physical separation process may not be viable in a number of reaches, however, Reach 1 may be suited to such a process due to the amount of cobble present in the targeted removal area in this reach. Additionally, washing of stone used to construct haul/access roads will be considered during final design as a mechanism to reduce disposal volume.

Dewatering of the excavated materials using gravity drainage (and any necessary mixing) will be performed at the staging area. Based on the physical characterization of the materials, as well as experience at similar sites, it has been assumed that the addition of up to 15% quicklime will be used to stabilize sediment before disposal. It is assumed that riverbank soils will not require stabilization, although the conservative assumptions for 15% quicklime addition to the sediments should provide for sufficient surplus quicklime to be added to bank soils as needed. The additional weight added by the quicklime is anticipated to be offset by the resultant reduction in water, resulting in no addition to the disposal tonnage due to the weight of the quicklime. Treatability testing will be conducted during final design and will provide for more specific additive requirements for optimum stabilization.

For purposes of disposal, it is assumed that no material will be shipped if it has freestanding water exceeding the paint filter test criterion. In addition, material for disposal should have a moisture content within five percentage points of the optimum moisture content (as determined by Proctor testing). It is anticipated that these criterion will be met, however, as discussed above, testing could be conducted during final design to confirm these assumptions. Assessment would also be performed in the field during removal operations to determine that these criterion are met. If necessary, to decrease moisture content to within the acceptable range, additional treatment or blending with drier material will be performed prior to shipping.

5.3 Handling of Water

This section describes the handling of water extracted from the removal areas to facilitate manageable excavation. It also describes the handling of water released from the removed materials as part of dewatering processes, as well as water resulting from equipment cleaning activities.

5.3.1 Excavation Dewatering

Water handling will be an ongoing and time-critical component of the sediment and soil removal activities. To this end, there are several important factors that must be considered for implementation. These include the following:

- *Filtering Capacity* – Due to the proximity of the water table and the fact that removal will be conducted within the creek/river, pumping and filtering capacity is an important consideration. For this conceptual design preliminary dewatering rate projections were developed by applying Darcy’s law for groundwater flow into the excavations with and without sheetpiling. The approach involved subdividing reach sections based on remedial approach configurations and excavation depths. Several assumptions were required to perform these rate calculations, which include the following:

- excavation configuration and depths;
- sheetpile and soil permeabilities;
- depths of the soil materials surrounding the excavation;
- hydraulic head differences from inside the dewatered excavations to outside the excavations, as well as; and
- standard Darcy's Law assumptions of laminar flow and homogeneous, isotropic soil conditions.

For the purpose of this assessment, sheetpile hydraulic conductivity was assumed to be 1×10^{-6} centimeters per second (0.0028 feet per day), and outwash soil material hydraulic conductivity was varied from 3×10^{-4} centimeters per second (0.85 feet per day) to 1×10^{-2} centimeters per second (2.8 feet per day). The lower value was more representative of the values generated from site-specific hydraulic conductivity tests. The higher value is typical for clean outwash soils and represents potential worst case conditions. Hydraulic conductivity of the till was assumed to be 1×10^{-6} centimeters per second (0.0028 feet per day). Hydraulic head differences were estimated by subtracting the pre-excavation creek/river elevations from the proposed excavation depths for each reach.

Table 5-1 summarizes the calculated dewatering rates for the various creek/river reaches and remedial approaches.

Calculated dewatering rates vary from 30 gpm to over 200 gpm depending on soil permeability and thicknesses of alluvium/outwash above low permeability till. The calculated dewatering rates are considerably sensitive to the thickness of alluvium/outwash soil surrounding the excavation. Utilization of sheeting keyed into till can significantly reduce projected dewatering rates. This will be further evaluated during detailed design.

- *Logistics* – Adequate pumps and piping would be available to keep the excavation areas dewatered and route the water to the filtering unit which will be located adjacent to each work area. For several of the remedial approaches, dewatering sumps will be set up within the removal areas in order to provide manageable excavation conditions. These sump systems will consist of a sump placed in gravel backfill with a submersible pump in each sump pumping through hose to the filtering system. Additionally, where necessary the pumps will pump to a main dewatering pump.

- *Filtering Effectiveness* – Timely sediment removal also requires that the sedimentation and erosion control area for filtering system effectively filter the water encountered. If the collected water cannot be adequately filtered and discharged, the sediment removal activities may need to be temporarily shut down. The primary method for filtering will involve use of a temporary, portable system consisting of an influent tank and a transfer pump to pump water through a bag filter. The system will be appropriately configured to accommodate the expected production rates, volume of water and particle size to allow for continuous operation. The system will be relocated from reach to reach as work progresses through the Site. Treatability study work during detailed design will be performed to optimize this system.

- *Temporary Discharge* – It is anticipated that filtered water will be discharged to the creek/river via a temporary discharge point in the vicinity of the work area(s). Obtaining a National Pollution Discharge Elimination System (NPDES) permit pursuant to 40 CFR 122.3(d) is not anticipated for this discharge. For this conceptual design it has been assumed that discharge monitoring will consist of monitoring for turbidity on a daily basis.

5.3.2 Materials Dewatering

The handling and filtering of water from dewatering of the stockpile and from equipment cleaning will be dependent upon the procedures and locations used for these activities. It is anticipated that the water accumulated from those activities will be pumped into the storage tank and will be filtered along with water generated during excavation dewatering.

5.4 Decontamination Areas

Equipment cleaning will be performed to prevent the transport of Site materials that may be present on any equipment used for construction-related activities and also minimize potential for cross contamination between soils that exceed the cleanup criterion and soils that test below the cleanup criterion. It is anticipated that decontamination activities for trucks, equipment, and personnel that come into contact with impacted materials during removal activities will be performed within the work area or at the staging area. Specific equipment cleaning procedures to be implemented will be established in detailed design and may include the following:

- If a separate equipment-cleaning area is constructed, it will generally consist of an impermeable barrier and will be bermed and sloped to contain and collect fluids. Side walls would be constructed to prevent errant overspray, especially during decontamination of large equipment.
- Precautions would be taken during loading and transport of removed materials. Trucks would be loaded over a tarp to protect the exterior of the truck from spillage of materials.
- Trucks will be loaded to only 50-75% of capacity in order to accommodate inclines/declines or other adverse conditions that may be encountered during transport. All vehicles will be equipped with sealable tailgates.
- Each transport vehicle will be visually inspected prior to leaving the loading area. Accumulations of soil or sediment on the vehicle tires or other exterior surfaces will be removed manually or, if necessary, by using a high- and low-pressure water spray.
- Material handling equipment that has been used to remove materials above the cleanup criterion will be cleaned in the equipment cleaning area prior to handling "clean" materials (e.g., overburden and backfill), or will leave the work area.
- Excavation activities will be sequenced (or dedicated equipment will be utilized) in a manner that will minimize the potential for cross-contamination or the need for repetitive decontamination of equipment.

5.5 Handling of Residual Wastes

Residual wastes likely to be generated during removal activities include used disposable equipment, personal protective equipment, sampling equipment, and cleaning residuals. Any residual wastes generated will be placed in stockpiles and will be disposed with the soils and sediments that exceed the cleanup criterion.

5.6 Handling of Regular Construction Wastes

Regular construction wastes (i.e., general refuse that has not contacted impacted materials) that are generated during the remedial activities will be managed by a local waste hauling vendor. This may include stripped vegetation, cleared trees, topsoil and excess overburden confirmed not to exceed the cleanup criterion.

6. References

Blasland, Bouck & Lee, Inc. (BBL). October 2002. *Conceptual Restoration Design Plan: Kress Creek/ West Branch DuPage River Site.*

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ProSource Technologies, Inc. October 2002. *Characterization Report for the Kress Creek/West Branch DuPage River Site.*

Roy F. Weston, Inc. March 2000. *Large Tree Inventory Report: Kress Creek and West Branch DuPage River.*

Tables

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engineers & scientists

Table 4-1

Summary of Reach-Specific Material Removal Volume Estimates

Conceptual Design Report
Kerr-McGee Chemical LLC
Kress Creek/West Branch DuPage River Site
DuPage County, Illinois

Reach	Estimated Volume (cy)						
	Sediment Materials		Floodplain Materials		Total		
	Exceeding the Cleanup Criterion	Below the Cleanup Criterion	Exceeding the Cleanup Criterion	Below the Cleanup Criterion	Exceeding the Cleanup Criterion	Below the Cleanup Criterion	Total Rounded Removal
1 -- Outfall to May Street	1,655	455	4,990	1,365	6,645	1,815	8,450
2 -- May Street to Joy Road	3,915	985	3,630	910	7,540	1,890	9,430
3 -- Joy Road to Route 59	665	115	6,235	1,080	6,895	1,195	8,080
4 -- Route 59 to Confluence	105	15	3,180	355	3,285	370	3,650
5 -- STP Outfall to Williams Road	1,175	730	13,125	8,155	14,300	8,885	23,180
6 -- Williams Road to Butterfield Road	735	895	1,295	1,580	2,030	2,475	4,500
7 -- Butterfield Road to Warrenville Dam	24,545	15,475	1,295	815	25,835	16,290	42,120
Total:	32,795	18,670	33,750	14,260	66,530	32,920	99,410

Notes:
1. Total surface areas were calculated by summing surface areas (obtained from ArcView) for all individual polygons within a specified reach. Volumes were calculated using the average depth of either material exceeding the cleanup criterion (i.e., 7.2 pCi/g) or material below the cleanup criterion provided for all boreholes within each polygon and multiplying by the total surface area for each polygon.
2. Volumes were further separated by sediment or floodplain based on the percent of total surface area for each reach that exists within or outside of the river boundary.
3. The extent of removal polygons is illustrated on Figure 1-1.
4. Volumes do not account for any vertical overexcavation of material.

Table 5-1

Summary of Estimated Dewatering Rates

Conceptual Design Report
Kerr McGee Chemical LLC
Kress Creek/West Branch DuPage River Site
DuPage County, Illinois

	Dewatering Rates	
	Sheet Pile K = 1 x 10^{-6} Soil K = 1 x 10^{-2}	**Sheet Pile K = 1 x 10^{-6} Soil K = 3 x 10^{-4}**
Reach 1 - Outfall to May Street (Kress Creek)	210	100
Reach 2 - May Street to Joy Road (Kress Creek)	80	30
Reach 3 - Joy Road to Route 59 (Kress Creek)	145	45
Reach 4 - Route 59 to Confluence (Kress Creek)	145	45
Reach 6 - Williams Road to Butterfield Road (West Branch DuPage River)	80	30
Reach 7 - Butterfield Road to Warrenville Dam (West Branch DuPage River)	200	70

Notes:
1. Estimated dewatering rates are in units of gallons per minute (gpm).
2. Hydraulic conductivity (K) units are in centimeters per second (cm/sec).

Table 4-2

Summary of Preferred Alternatives

Conceptual Design Report
Kerr-McGee Chemical LLC
Kress Creek/West Branch DuPage River Site
DuPage County, Illinois

Alternative	Duration (weeks)	Preliminary Estimated Cost (in millions)	Total Processed Soil and Sediment Tons	Tons of Stone for T&D	Rounded Total Tons For Disposal
Reach 1, Alternative 1- Excavation performed through the use of dewatering, including sheetpile near the railroad/outfall area and pump bypass	12.5	$7.0	9,320	838	10,200
Reach 2, Alternative 1- Excavation performed through the use of dewatering, including sheetpile around the northwest lake area and pump bypass	13.5	$7.0	10,711	189	10,900
Reach 3, Alternative 3- Excavation performed through the use of dewatering, including use of berms and pump bypass	8	$5.9	9,621	1,484	11,100
Reach 4, Alternative 3- Excavation performed through the use of dewatering, with berms at Route 59/confluence and pump bypass	5	$2.8	4,570	706	5,300
Reach 5, Alternative 3- Excavation performed through the use of dewatering, including use of sheetpile and pump bypass (stretch from STP Outfall to Gary's Mill Road will be excavated as in Alternative 1)	28.5	$17.7	21,295	1,126	22,400
Reach 6, Alternative 2- Excavation performed through the use of dewatering, with sheetpile around each removal area (except sand bags for water diversion around smaller west shore and upstream areas)	12	$4.7	2,862	1,719	4,600
Reach 7, Alternative 1- Excavation performed through the use of dewatering, including sheetpile to divert flow	33	$18.2	37,383	1,632	39,000
Total:	**112.5**	**$63.3**	**95,762**	**7,694**	**103,500**

Notes:

1. Preliminary cost estimates include: engineering and design estimated at 5% of construction and restoration plus predesign investigation costs at $75,000 per reach; monitoring costs estimated at $7,500 per week; and a 20% contingency.

Figures

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KERR-McGEE CHEMICAL LLC
KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL

CONCEPTUAL DESIGN REPORT

SITE LOCATION MAP

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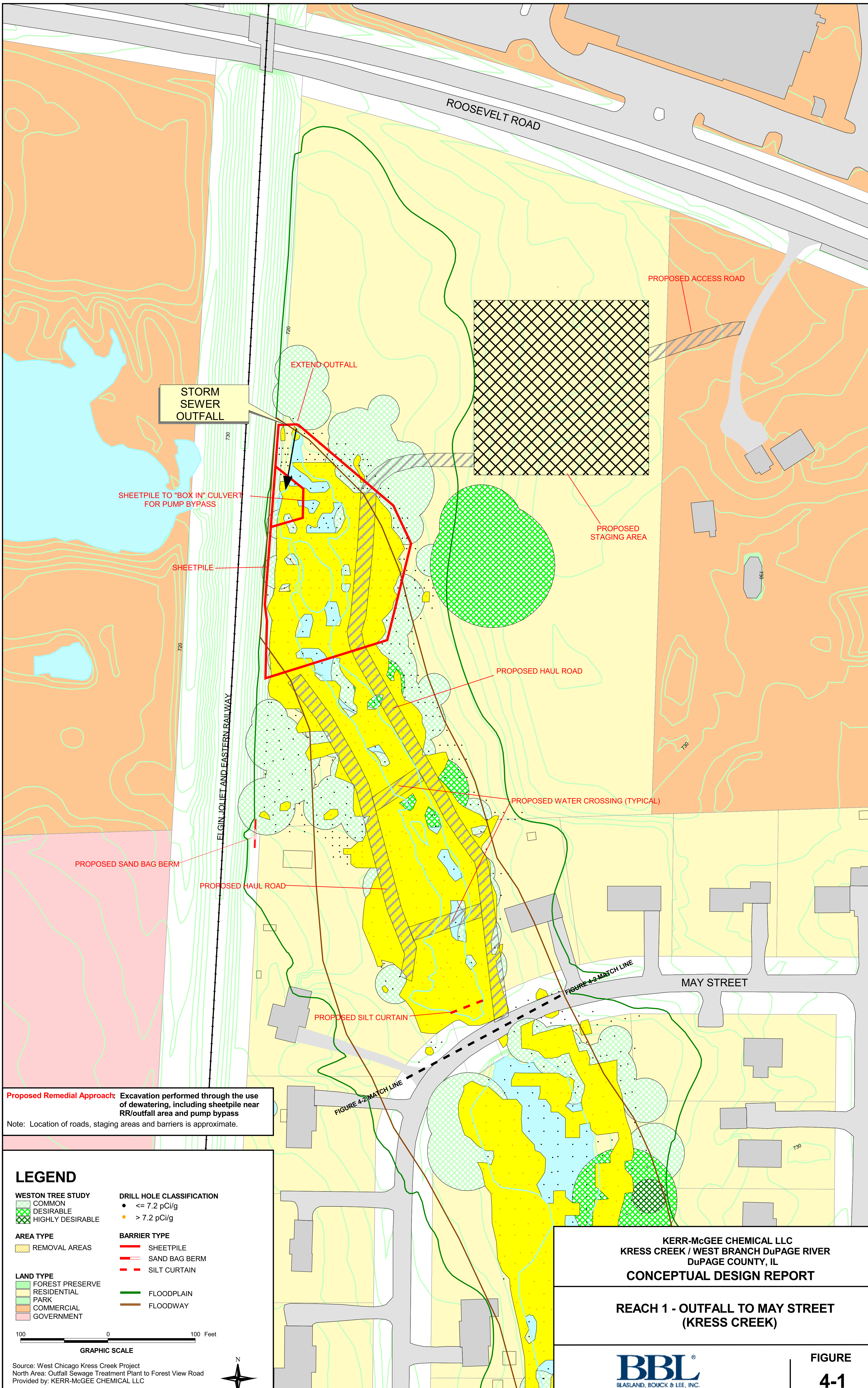
FIGURE 1-1



Proposed Remedial Approach: **Excavation performed through the use of dewatering, including sheetpile near RR/outfall area and pump bypass**

Note: Location of roads, staging areas and barriers is approximate.

LEGEND

WESTON TREE STUDY
- COMMON
- DESIRABLE
- HIGHLY DESIRABLE

DRILL HOLE CLASSIFICATION
- <= 7.2 pCi/g
- > 7.2 pCi/g

AREA TYPE
- REMOVAL AREAS

BARRIER TYPE
- SHEETPILE
- SAND BAG BERM
- SILT CURTAIN

LAND TYPE
- FOREST PRESERVE
- RESIDENTIAL
- PARK
- COMMERCIAL
- GOVERNMENT

- FLOODPLAIN
- FLOODWAY

100 0 100 Feet

GRAPHIC SCALE

Source: West Chicago Kress Creek Project
North Area: Outfall Sewage Treatment Plant to Forest View Road
Provided by: KERR-McGEE CHEMICAL LLC

N

Q:\KMGee\APR\ConceptualDesign11x17.apr: Figure 1

KERR-McGEE CHEMICAL LLC
KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL

CONCEPTUAL DESIGN REPORT

REACH 1 - OUTFALL TO MAY STREET (KRESS CREEK)

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FIGURE 4-1

Proposed Remedial Approach Excavation performed through the use of dewatering, with sheetpile around each removal area (except turbidity barriers or sand bags for water diversion around smaller west shore and upstream areas)

Note: Location of roads, staging areas and barriers is approximate.

LEGEND

WESTON TREE STUDY
- COMMON
- DESIRABLE
- HIGHLY DESIRABLE

DRILL HOLE CLASSIFICATION
- <= 7.2 pCi/g
- > 7.2 pCi/g

AREA TYPE
- REMOVAL AREAS
- PROPERTIES WITHOUT ACCESS AGREEMENT

BARRIER TYPE
- TURBIDITY BARRIERS (OR SAND BAGS)
- SHEETPILE
- SILT CURTAIN

LAND TYPE
- FOREST PRESERVE
- RESIDENTIAL
- PARK
- COMMERCIAL
- GOVERNMENT

- MINOR ACCESS ROAD
- FLOODPLAIN
- FLOODWAY

200 0 200 400 Feet

GRAPHIC SCALE

N

Source: West Chicago Kress Creek Project
South Area: Forest View Drive to Warrenville Dam
Provided by: KERR-McGEE CHEMICAL LLC

C:\KMGee\APR\ConceptualDesign11x17.apr: Figure 6

KERR-McGEE CHEMICAL LLC
KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL

CONCEPTUAL DESIGN REPORT

REACH 6 - WILLIAMS ROAD TO BUTTERFIELD ROAD (WEST BRANCH DuPAGE RIVER)

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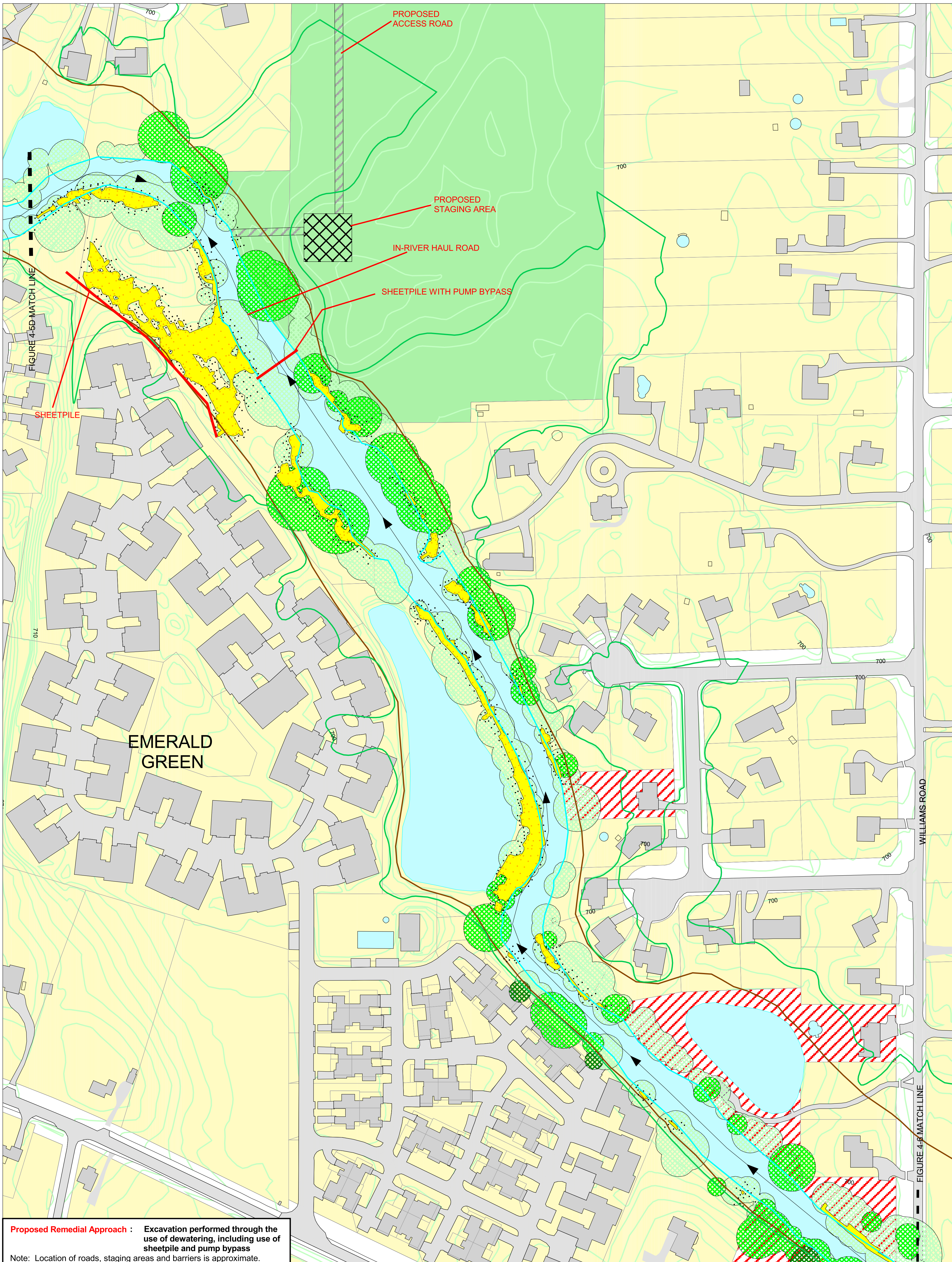
FIGURE 4-6



Proposed Remedial Approach : **Excavation performed through the use of dewatering, including use of sheetpile and pump bypass**

Note: Location of roads, staging areas and barriers is approximate.

LEGEND

WESTON TREE STUDY
- COMMON
- DESIRABLE
- HIGHLY DESIRABLE

DRILL HOLE CLASSIFICATION
- <= 7.2 pCi/g
- > 7.2 pCi/g

AREA TYPE
- REMOVAL AREAS
- PROPERTIES WITHOUT ACCESS AGREEMENT

BARRIER TYPE
- SHEETPILE

LAND TYPE
- FOREST PRESERVE
- RESIDENTIAL
- PARK
- COMMERCIAL
- GOVERNMENT

- FLOODPLAIN
- FLOODWAY

200 0 200 Feet

GRAPHIC SCALE

N

SOURCE: West Chicago Kress Creek Project
South Area: Forest View Drive to Warrenview Dam
Provided by: KERR-McGEE CHEMICAL LLC

C:\KMGee\APR\ConceptualDesign11x17.apr: Figure 5E

KERR-McGEE CHEMICAL LLC
KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL

CONCEPTUAL DESIGN REPORT

REACH 5 -STP OUTFALL TO WILLIAMS ROAD (WEST BRANCH DuPAGE RIVER)

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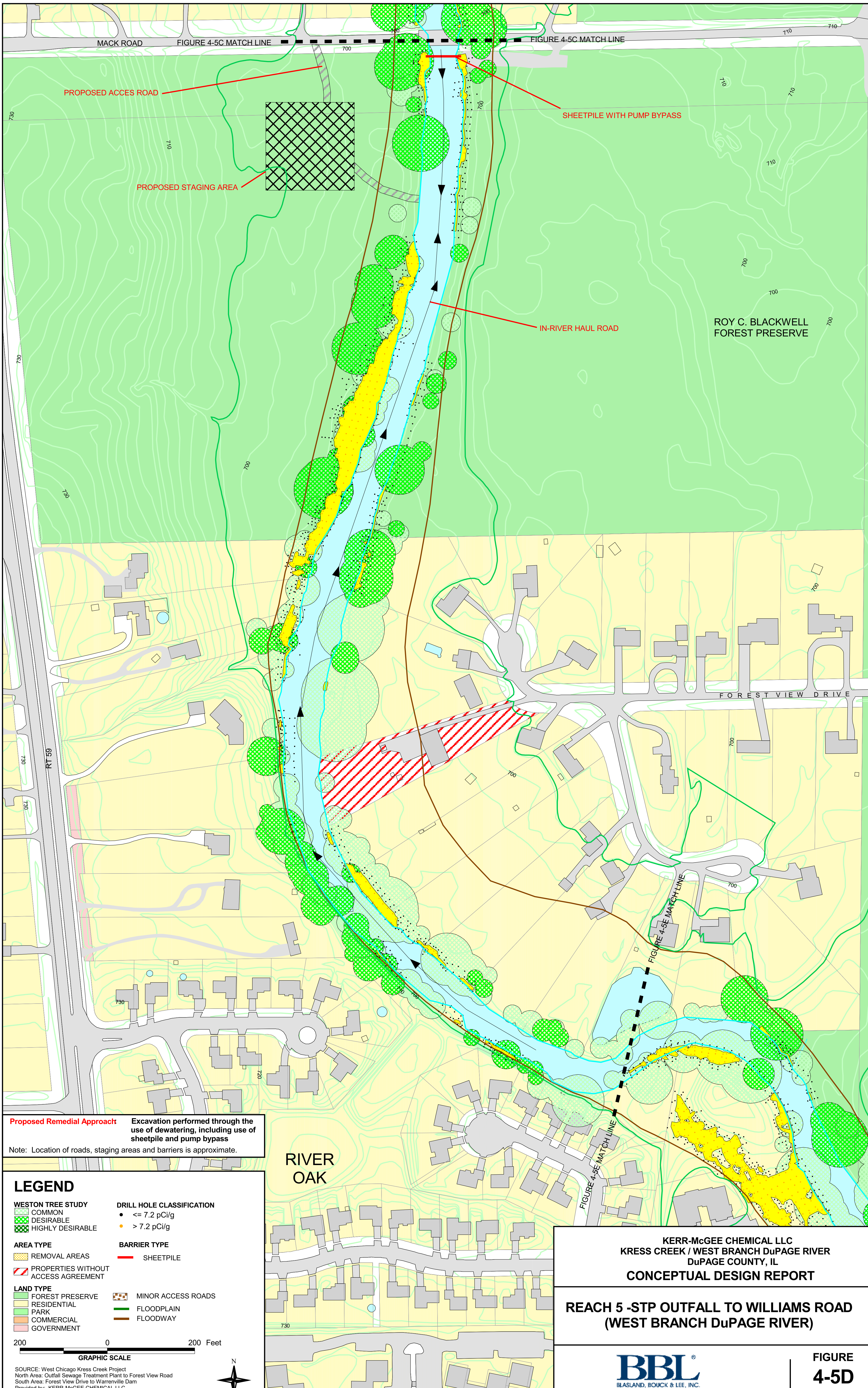
FIGURE
4-5E



Proposed Remedial Approach: **Excavation performed through the use of dewatering, including use of sheetpile and pump bypass**

Note: Location of roads, staging areas and barriers is approximate.

LEGEND

WESTON TREE STUDY
- COMMON
- DESIRABLE
- HIGHLY DESIRABLE

DRILL HOLE CLASSIFICATION
- <= 7.2 pCi/g
- > 7.2 pCi/g

AREA TYPE
- REMOVAL AREAS
- PROPERTIES WITHOUT ACCESS AGREEMENT

BARRIER TYPE
- SHEETPILE

LAND TYPE
- FOREST PRESERVE
- RESIDENTIAL
- PARK
- COMMERCIAL
- GOVERNMENT

- MINOR ACCESS ROADS
- FLOODPLAIN
- FLOODWAY

200 0 200 Feet

GRAPHIC SCALE

N

SOURCE: West Chicago Kress Creek Project
North Area: Outfall Sewage Treatment Plant to Forest View Road
South Area: Forest View Drive to Warrenville Dam
Provided by: KERR-McGEE CHEMICAL LLC

C:\KMGee\APR\ConceptualDesign11x17.apr: Figure 5D

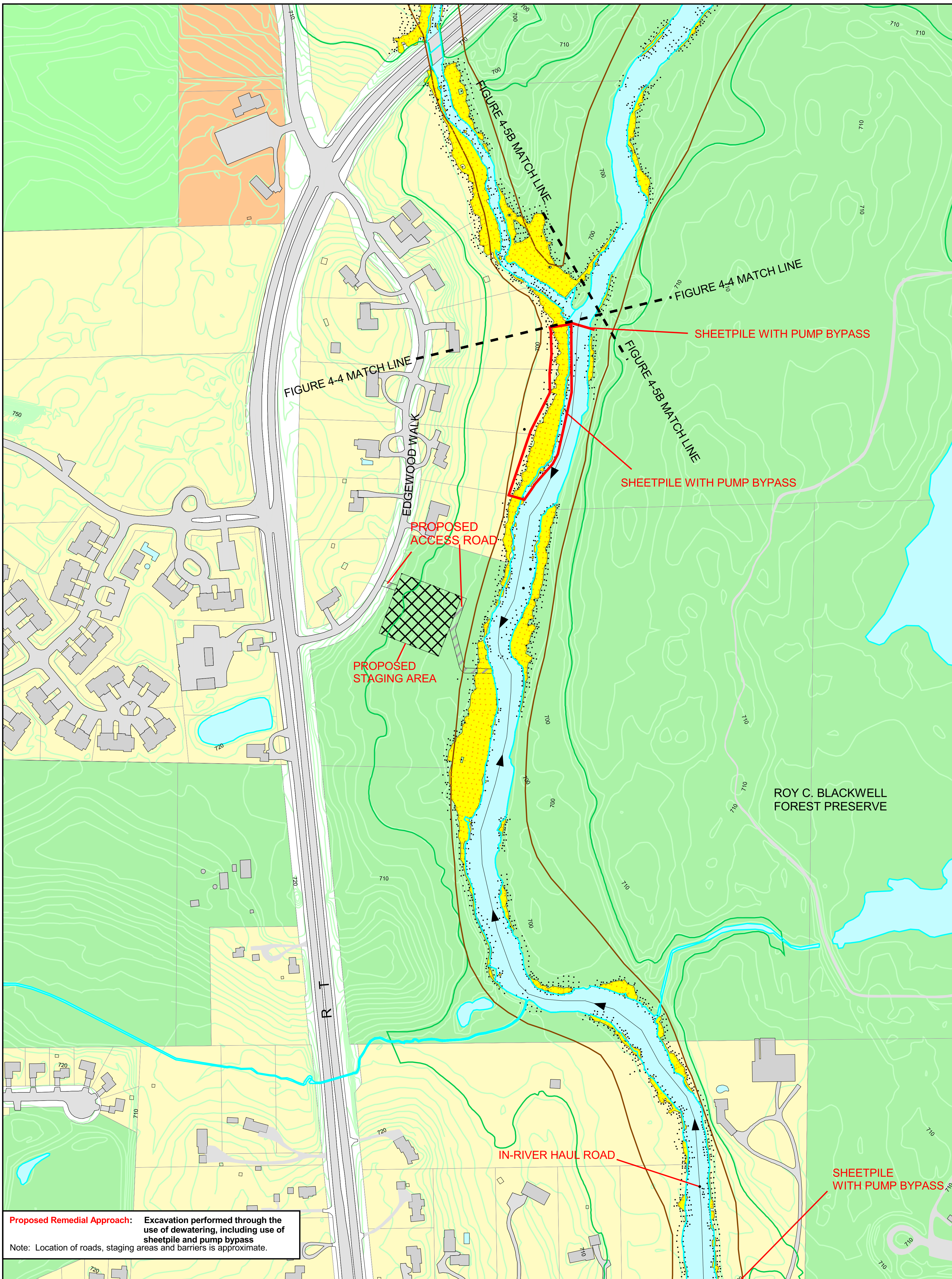
KERR-McGEE CHEMICAL LLC
KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL

CONCEPTUAL DESIGN REPORT

REACH 5 -STP OUTFALL TO WILLIAMS ROAD
(WEST BRANCH DuPAGE RIVER)

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE
4-5D



Proposed Remedial Approach: Excavation performed through the use of dewatering, including use of sheetpile and pump bypass

Note: Location of roads, staging areas and barriers is approximate.

LEGEND

WESTON TREE STUDY
- COMMON
- DESIRABLE
- HIGHLY DESIRABLE

DRILL HOLE CLASSIFICATION
- <= 7.2 pCi/g
- > 7.2 pCi/g

AREA TYPE
- REMOVAL AREAS

BARRIER TYPE
- SHEETPILE

LAND TYPE
- FOREST PRESERVE
- RESIDENTIAL
- PARK
- COMMERCIAL
- GOVERNMENT

- FLOODPLAIN
- FLOODWAY

300 0 300 Feet

GRAPHIC SCALE

N

SOURCE: West Chicago Kress Creek Project
North Area: Outfall Sewage Treatment Plant to Forest View Road
Provided by: KERR-McGEE CHEMICAL LLC

C:\KMGee\APR\ConceptualDesign11x17.apr: Figure 5C

KERR-McGEE CHEMICAL LLC
KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL

CONCEPTUAL DESIGN REPORT

REACH 5 -STP OUTFALL TO WILLIAMS ROAD (WEST BRANCH DuPAGE RIVER)

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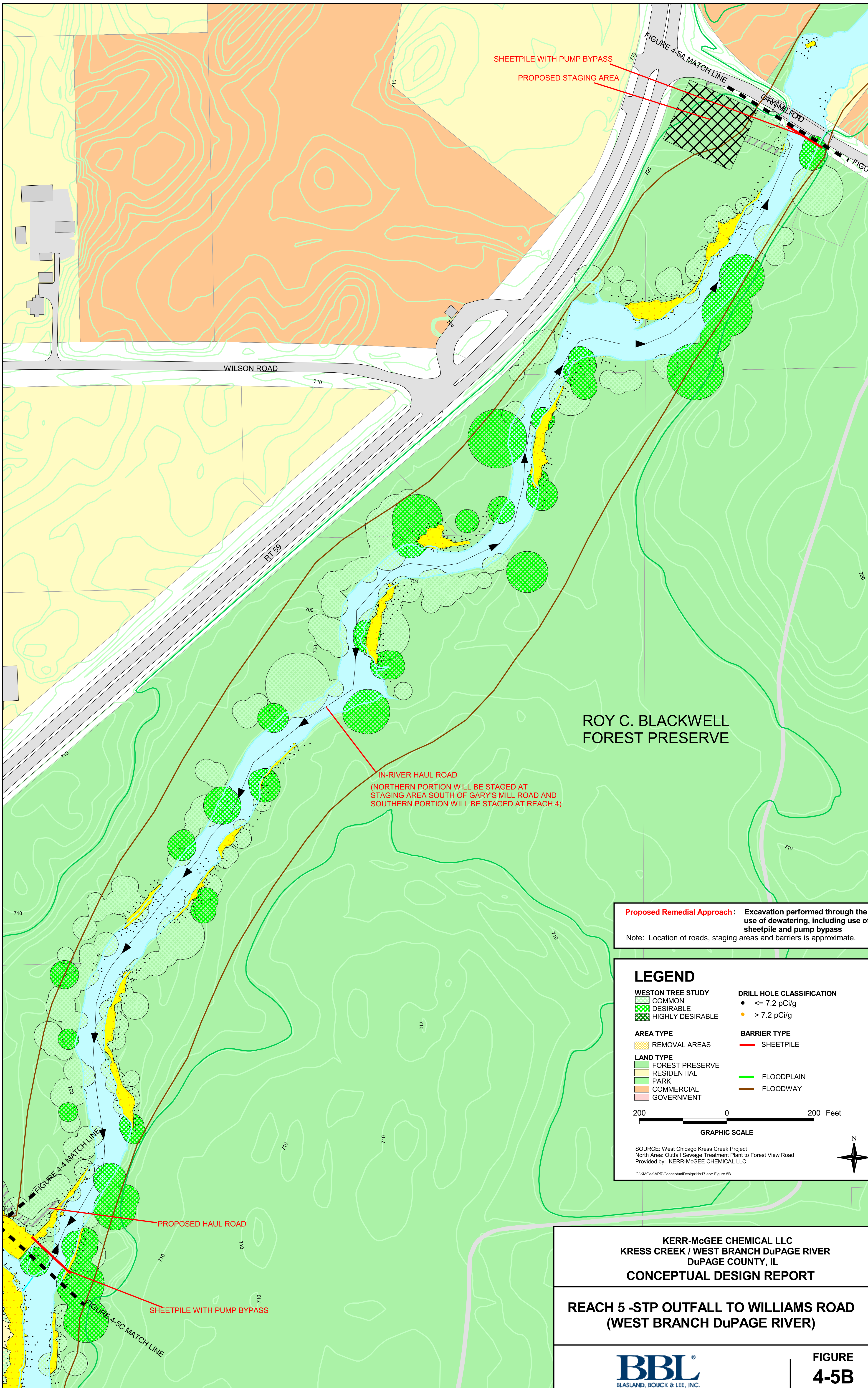
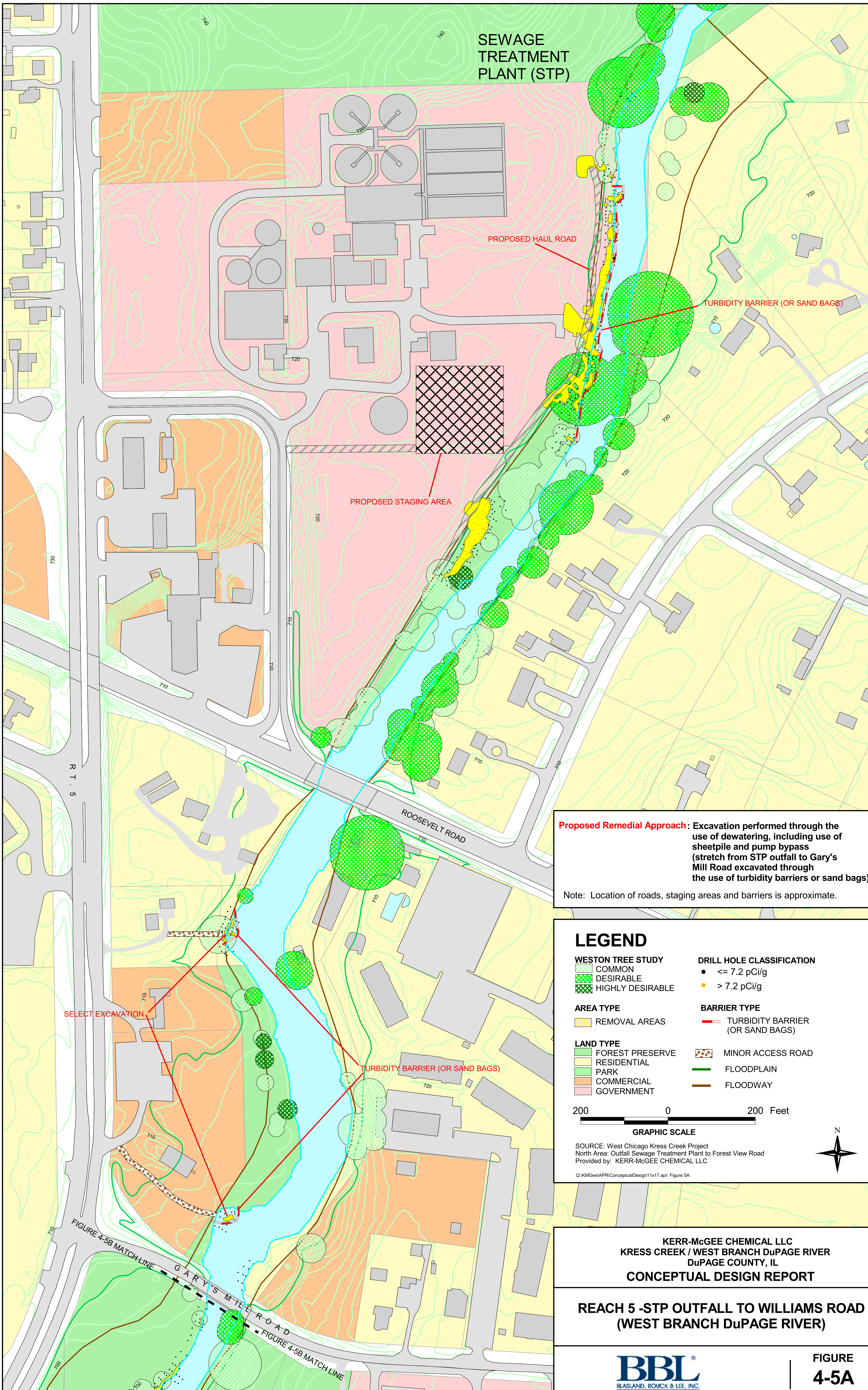
FIGURE
4-5C



SHEETPILE WITH PUMP BYPASS
PROPOSED STAGING AREA
FIGURE 4-5A MATCH LINE
GARYS MILL ROAD
WILSON ROAD
RT 59
ROY C. BLACKWELL
FOREST PRESERVE
IN-RIVER HAUL ROAD
(NORTHERN PORTION WILL BE STAGED AT
STAGING AREA SOUTH OF GARY'S MILL ROAD AND
SOUTHERN PORTION WILL BE STAGED AT REACH 4)
FIGURE 4-4 MATCH LINE
PROPOSED HAUL ROAD
SHEETPILE WITH PUMP BYPASS
FIGURE 4-5C MATCH LINE
700
710
720
Proposed Remedial Approach : Excavation performed through the use of dewatering, including use of sheetpile and pump bypass
Note: Location of roads, staging areas and barriers is approximate.
LEGEND
WESTON TREE STUDY
COMMON
DESIRABLE
HIGHLY DESIRABLE
DRILL HOLE CLASSIFICATION
<= 7.2 pCi/g
> 7.2 pCi/g
AREA TYPE
REMOVAL AREAS
BARRIER TYPE
SHEETPILE
LAND TYPE
FOREST PRESERVE
RESIDENTIAL
PARK
COMMERCIAL
GOVERNMENT
FLOODPLAIN
FLOODWAY
200 0 200 Feet
GRAPHIC SCALE
SOURCE: West Chicago Kress Creek Project
North Area: Outfall Sewage Treatment Plant to Forest View Road
Provided by: KERR-McGEE CHEMICAL LLC
N
KERR-McGEE CHEMICAL LLC
KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL
CONCEPTUAL DESIGN REPORT
REACH 5 -STP OUTFALL TO WILLIAMS ROAD
(WEST BRANCH DuPAGE RIVER)
BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists
FIGURE
4-5B



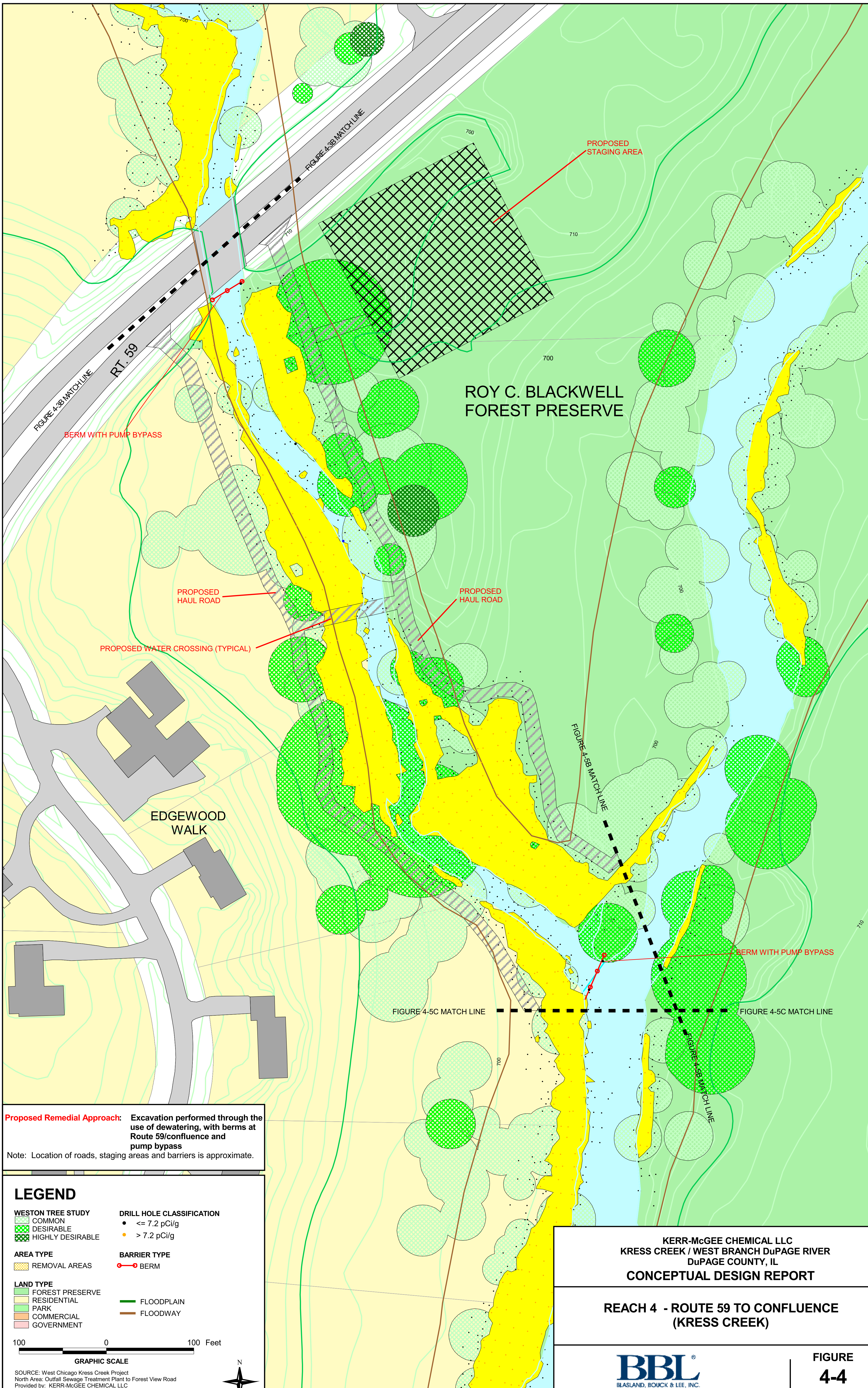
KERR-McGEE CHEMICAL LLC
KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL

CONCEPTUAL DESIGN REPORT

REACH 5 -STP OUTFALL TO WILLIAMS ROAD (WEST BRANCH DuPAGE RIVER)

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4-5A



Proposed Remedial Approach: **Excavation performed through the use of dewatering, with berms at Route 59/confluence and pump bypass**

Note: Location of roads, staging areas and barriers is approximate.

LEGEND

WESTON TREE STUDY
- COMMON
- DESIRABLE
- HIGHLY DESIRABLE

DRILL HOLE CLASSIFICATION
- <= 7.2 pCi/g
- > 7.2 pCi/g

AREA TYPE
- REMOVAL AREAS

BARRIER TYPE
- BERM

LAND TYPE
- FOREST PRESERVE
- RESIDENTIAL
- PARK
- COMMERCIAL
- GOVERNMENT

- FLOODPLAIN
- FLOODWAY

100 0 100 Feet

GRAPHIC SCALE

SOURCE: West Chicago Kress Creek Project
North Area: Outfall Sewage Treatment Plant to Forest View Road
Provided by: KERR-McGEE CHEMICAL LLC

Q:\KMGee\APR\bConceptualDesign11x17.apr: Figure 4

N

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DuPAGE COUNTY, IL

CONCEPTUAL DESIGN REPORT

REACH 4 - ROUTE 59 TO CONFLUENCE (KRESS CREEK)

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FIGURE
4-4

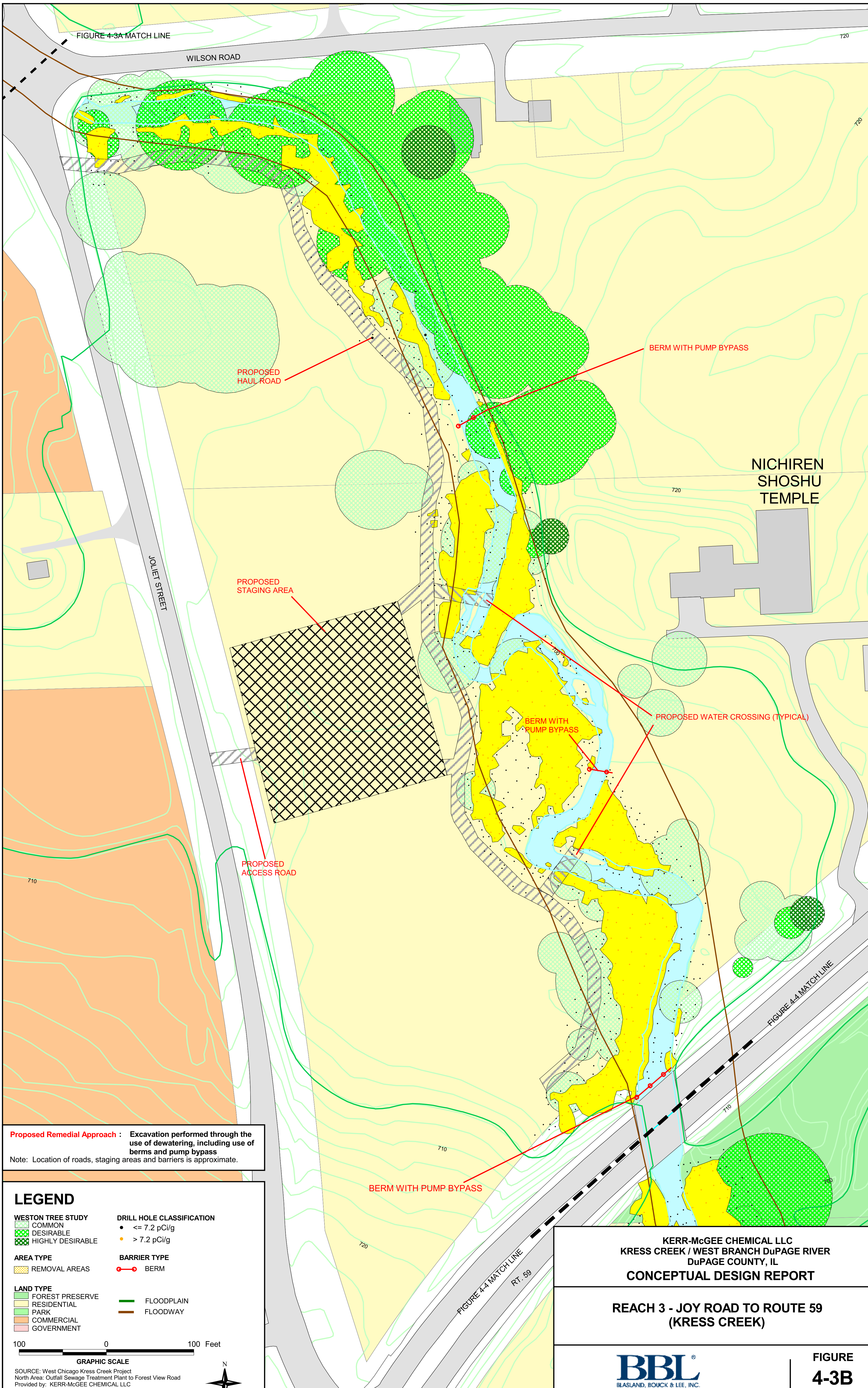

FIGURE 4-3A MATCH LINE
WILSON ROAD
720
JOLIET STREET
NICHIREN
SHOSHU
TEMPLE
BERM WITH PUMP BYPASS
PROPOSED
HAUL ROAD
PROPOSED
STAGING AREA
PROPOSED WATER CROSSING (TYPICAL)
BERM WITH
PUMP BYPASS
PROPOSED
ACCESS ROAD
710
700
FIGURE 4-4 MATCH LINE
RT. 59
BERM WITH PUMP BYPASS
Proposed Remedial Approach : Excavation performed through the use of dewatering, including use of berms and pump bypass
Note: Location of roads, staging areas and barriers is approximate.
LEGEND
WESTON TREE STUDY
COMMON
DESIRABLE
HIGHLY DESIRABLE
DRILL HOLE CLASSIFICATION
<= 7.2 pCi/g
> 7.2 pCi/g
AREA TYPE
REMOVAL AREAS
BARRIER TYPE
BERM
LAND TYPE
FOREST PRESERVE
RESIDENTIAL
PARK
COMMERCIAL
GOVERNMENT
FLOODPLAIN
FLOODWAY
100 0 100 Feet
GRAPHIC SCALE
SOURCE: West Chicago Kress Creek Project
North Area: Outfall Sewage Treatment Plant to Forest View Road
Provided by: KERR-McGEE CHEMICAL LLC
N
KERR-McGEE CHEMICAL LLC
KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL
CONCEPTUAL DESIGN REPORT
REACH 3 - JOY ROAD TO ROUTE 59
(KRESS CREEK)
BBL
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engineers & scientists
FIGURE
4-3B

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KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL

CONCEPTUAL DESIGN REPORT

REACH 3 - JOY ROAD TO ROUTE 59 (KRESS CREEK)

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FIGURE 4-3A

Proposed Remedial Approach : **Excavation performed through the use of dewatering, including sheetpile around the northwest lake area and pump bypass**

Notes:
1. Location of roads, staging areas and barriers is approximate.
2. The same pump bypass system from Reach 1 (Figure 4-1) will be used for water diversion in Reach 2.

LEGEND

WESTON TREE STUDY
- COMMON
- DESIRABLE
- HIGHLY DESIRABLE

DRILL HOLE CLASSIFICATION
- <= 7.2 pCi/g
- > 7.2 pCi/g

AREA TYPE
- REMOVAL AREAS

BARRIER TYPE
- SHEETPILE
- SAND BAG BERM
- SILT CURTAIN

LAND TYPE
- FOREST PRESERVE
- RESIDENTIAL
- PARK
- COMMERCIAL
- GOVERNMENT

- FLOODPLAIN
- FLOODWAY

100 0 100 Feet
GRAPHIC SCALE

Source: West Chicago Kress Creek Project
North Area: Outfall Sewage Treatment Plant to Forest View Road
Provided by: KERR-McGEE CHEMICAL LLC

N

Q:\KMGee\APR\ConceptualDesign11x17: Figure 2

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KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL

CONCEPTUAL DESIGN REPORT

REACH 2 - MAY STREET TO JOY ROAD
(GUNNESS LAKE ON KRESS CREEK)

BBL
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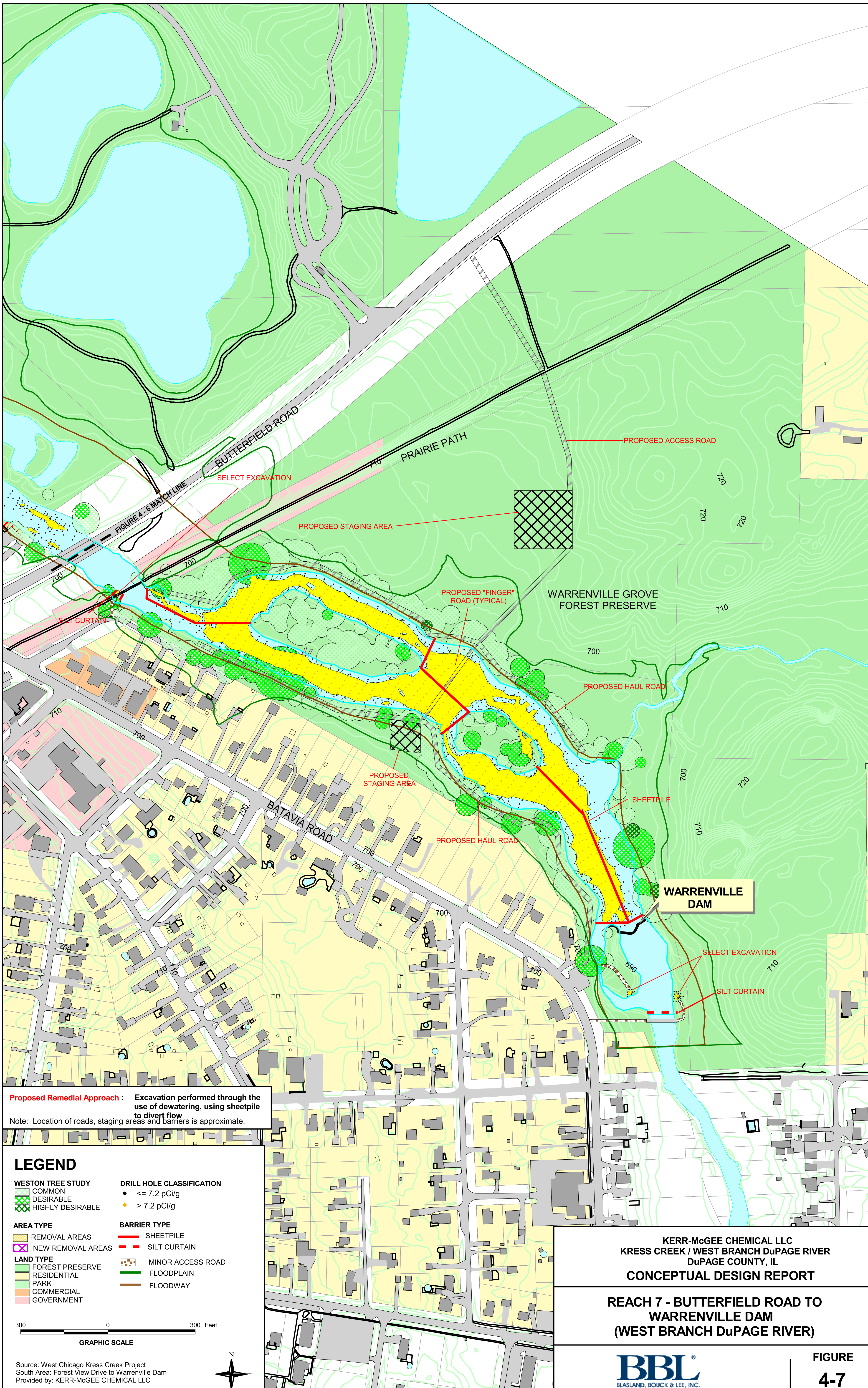
engineers & scientists

FIGURE
4-2



Proposed Remedial Approach : Excavation performed through the use of dewatering, using sheetpile to divert flow

Note: Location of roads, staging areas and barriers is approximate.

LEGEND

WESTON TREE STUDY
- COMMON
- DESIRABLE
- HIGHLY DESIRABLE

DRILL HOLE CLASSIFICATION
- <= 7.2 pCi/g
- > 7.2 pCi/g

AREA TYPE
- REMOVAL AREAS
- NEW REMOVAL AREAS

BARRIER TYPE
- SHEETPILE
- SILT CURTAIN

LAND TYPE
- FOREST PRESERVE
- RESIDENTIAL
- PARK
- COMMERCIAL
- GOVERNMENT

- MINOR ACCESS ROAD
- FLOODPLAIN
- FLOODWAY

300 0 300 Feet
GRAPHIC SCALE

N

Source: West Chicago Kress Creek Project
South Area: Forest View Drive to Warrenville Dam
Provided by: KERR-McGEE CHEMICAL LLC

C:\KMGee\APR\ConceptualDesign11x17.apr: Figure 7

KERR-McGEE CHEMICAL LLC
KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL
CONCEPTUAL DESIGN REPORT

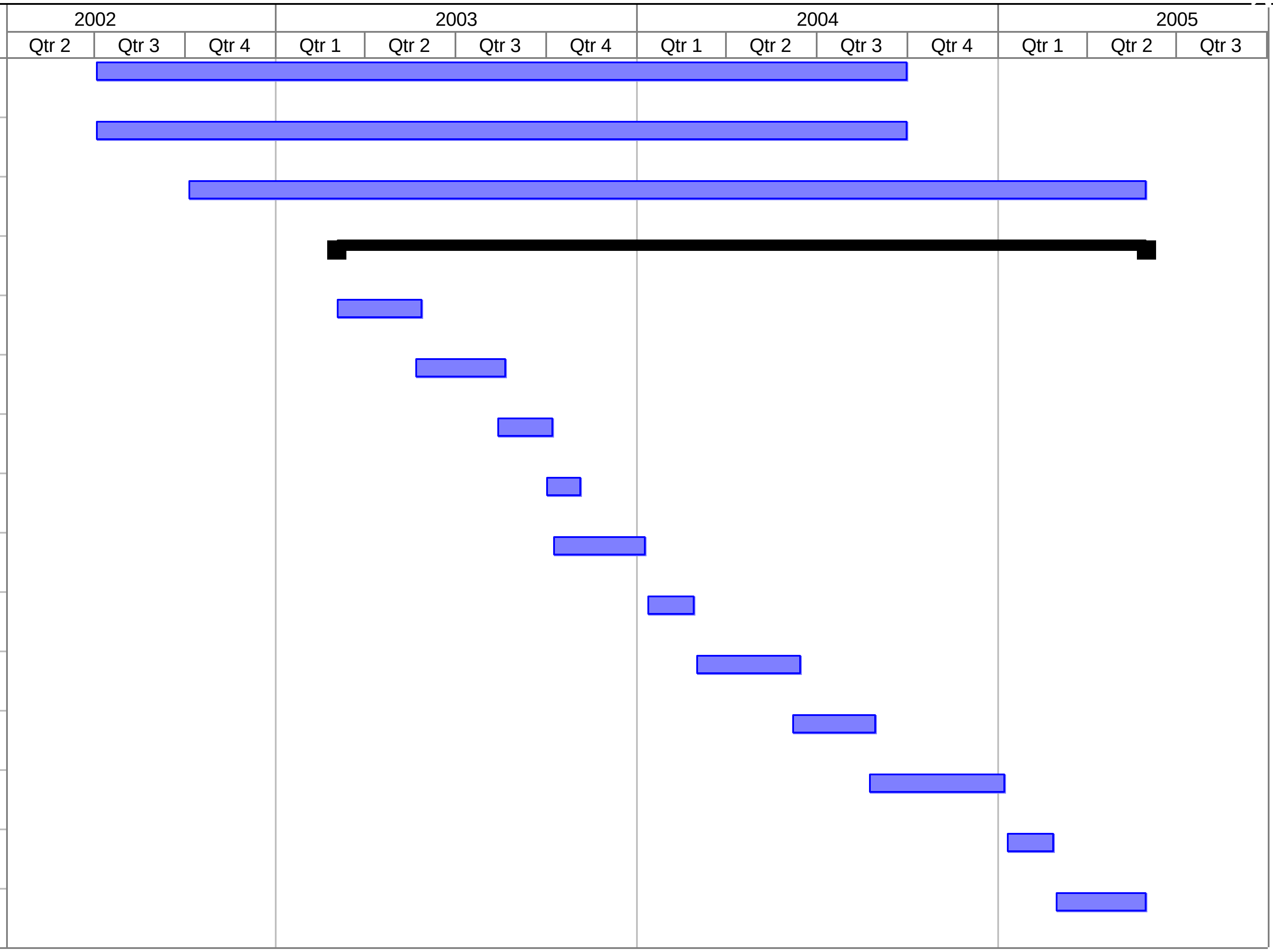
REACH 7 - BUTTERFIELD ROAD TO WARRENVILLE DAM (WEST BRANCH DuPAGE RIVER)

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
4-7

Figure 4-8 Preliminary Schedule

ID	Task Name
1	Detailed Design
2	Permitting/Approvals
3	Community Relations
4	**Construction Activities**
5	Reach 1
6	Reach 2
7	Reach 3
8	Reach 4
9	Reach 5
10	Winter Shutdown - 2004
11	Reach 5 (cont'd)
12	Reach 6
13	Reach 7
14	Winter Shutdown - 2005
15	Reach 7 (cont'd)



Project: KMG-conceptdesgn
Date: Wed 10/23/02

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	

Appendix A

Preliminary Assessment of Increasing Flooding and Scour Potential During Reach 8 Remediation

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Appendix A - Hydraulic Modeling Results - Kress Creek and West Branch DuPage River Site

1. Introduction

Hydraulic modeling was performed for Kress Creek and the West Branch DuPage River to compute flow velocities and water surface elevations (WSE) for a range of flow conditions for existing or “baseline” conditions and conditions during implementation of the proposed remedial approach for each reach. The hydraulic modeling efforts had the following goals:

- Assess how placement of water diversion structures (e.g. sheetpile, sand bags, and berms) would affect WSE and in-stream flow velocities during remedial activities; and
- Calculate in-stream flow velocities and WSE for current channel geometry to support post-remediation stream restoration design.

The modeling tasks employed several hydraulic models. Detailed, time-variable hydraulic models of the West Branch DuPage River and Kress Creek developed by the DuPage County Department of Environmental Concerns (DuPage DEC) were used to assess flow behavior under baseline conditions. These models were developed using the Full Equations Model (FEQ) code. A steady-state hydraulic model was developed by Blasland, Bouck & Lee, Inc. (BBL) for the portion of the Kress Creek/West Branch DuPage River system being considered for remediation using a model developed by the United States Army Corps of Engineers (USACE) Hydrologic Engineering Center called the River Analysis System (HEC-RAS). Both FEQ and HEC-RAS are one-dimensional river hydraulics models. The information in the FEQ model received from DuPage DEC[1] was used extensively to develop the HEC-RAS model. The HEC-RAS model is freely available by download from the USACE internet site.

The continuous simulation results for flood events obtained by running the DuPage DEC models for Kress Creek and the West Branch DuPage River provided information on baseline flow conditions and provided input to the HEC-RAS model in the form of stage-discharge rating curves used to specify upstream and downstream model boundary conditions. The information in the FEQ input decks provided the majority of the information used to develop the HEC-RAS model. The HEC-RAS model was used to simulate effects on WSE of

[1] Transmittal via FedEx by Christine Klepp, DuPage County Department of Environmental Concerns to Mike Erickson, Blasland, Bouck, and Lee, Inc. March 7, 2002.

remediation water diversion structures such as sheetpile and berms. The HEC-RAS model has user-friendly input/output capabilities facilitating assessment of these effects. Use of the existing FEQ models provided by DuPage DEC for evaluating the remedial approaches would have required significantly more time and effort than would be appropriate at a conceptual design stage.

The assessment of effects of remediation structures presented here based on the HEC-RAS results was conducted to provide preliminary design information for purposes of conceptual design only. It is anticipated that various features of the HEC-RAS model would be reviewed and further developed prior to use of results in any detailed remedial design activities. Model input information for floodplain properties, hydraulic structures, and river cross-section elevations should be reviewed. Information sources used by DuPage DEC should be investigated to assess accuracy and potential data collection needs for final design modeling. Additionally, simplifying assumptions employed in representing remedial structures in the model should be reviewed and improved as necessary to support final design for the structures. Also, it should be noted that the HEC-RAS model was not calibrated to any data. It was compared to the DuPage DEC model predictions under the assumption that this model provides an accurate representation of flood flow WSE. The HEC-RAS model results compared reasonably well with the FEQ model results in most locations. Agreement of both models with data should be assessed before use in any detailed design activities.

The following information was obtained through this effort to support the evaluation of remedial approaches:

- Hydraulic characteristics of the portions of the Kress Creek/West Branch DuPage River being considered for remediation;
- Approximate flood return frequencies;
- Baseline WSE and peak flow velocities for select flood events to aid in conceptual design of channel restoration approaches;
- Stage-discharge rating curves at locations of interest for evaluation of pump bypass alternatives;
- Predicted increases in flood WSE for the 2-year and 25-year flood events with placement of sheetpile along the banks for water diversion;
- Predicted increases in flood WSE and channel velocity for placement of diversion walls to direct flow around the islands in Warrenville Lake; and
- A water balance to assess major flow sources and pathways in Warrenville Lake during flood events.

The following sections present the methods and results of this assessment in detail.

2. Modeling Approach

Two different hydraulic models were used. Time-variable hydraulic models of the entire Kress Creek channel and the entire West Branch DuPage River channel constructed using the FEQ developed by the United States Geological Survey (USGS, 1997)[2] were obtained from the DuPage DEC. DuPage DEC has developed the FEQ Kress Creek and West Branch DuPage River models over a number of years and has prepared long-term continuous hydrology/hydraulics simulations extending as far back as 1925 and up to the 1990s. These models are complex time-variable simulations and include extensive information on river channel and floodplain geometry, hydraulic structures, and hydrologic inputs. A drawback of the FEQ model framework is that it lacks easy-to-use visual input/output data processing utilities and requires considerably more effort to apply than other similar, although perhaps less sophisticated, models.

The information in the FEQ model input files for Kress Creek and the West Branch DuPage River that were obtained from DuPage DEC was used to develop steady-state hydraulic models using HEC-RAS (USACE, 2001)[3] for portions of each channel to simulate placement of water diversion structures during remediation. The HEC-RAS model of Kress Creek was limited to the 1.4-mile reach downstream of the Elgin Joliet & Eastern Railroad (EJ&E RR). The HEC-RAS model of the West Branch DuPage River was limited to the 4.4-mile reach between the Sewage Treatment Plant (STP) just upstream of Roosevelt Road and the Warrenville Dam. The HEC-RAS model reaches and cross-sections are shown on Figure 1.

Information taken from the FEQ input deck for use in the HEC-RAS model included river cross-section elevations and station distances, bottom roughness coefficients, bridge and culvert dimensions, and hydraulic properties. Plots of river cross-section elevations provided by Kerr-McGee were used to check FEQ input data and to make adjustments at several locations. FEQ model results were also used to develop input information to HEC-RAS. Average downstream flow profiles computed by FEQ were used to develop flow inputs. The FEQ model results in the form of stage-discharge rating curves (correlations between WSE and flow rate) at either end of the HEC-RAS model on both the creek and the river were used to specify HEC-RAS model boundary elevations.

[2] USGS. 1997. Full Equations (FEQ) Model for the Solution of the Full, Dynamic Equations of Motion for One-Dimensional Unsteady Flow in Open Channels and through Control Structures. Water-Resources Investigations Report 96-4240.

[3] U.S. Army Corps of Engineers. 2001. HEC-RAS River Analysis System, Version 3.0.

Use of HEC-RAS permitted manipulation of channel geometry and flow conditions to simulate effects of remediation on flow conditions for a range of flows. The HEC-RAS model was compared to FEQ model results to ensure that reasonable representation of the hydraulics of Kress Creek and the West Branch DuPage River was obtained. This assumed that the development efforts invested by DuPage DEC resulted in acceptable accuracy of the FEQ model predictions for both the creek and the river. Typically, WSE differed by less than one foot for the 25-year flood flow, and in most locations, differences were six inches or less. For lower flows, differences were smaller. Overall, the HEC-RAS model performance was considered adequate for use in conceptual design evaluation of the proposed remedial approach for each reach.

Following predictions of "baseline" (based on current channel geometry) WSE, using the FEQ model, the HEC-RAS model was used to compute downstream WSE and flow velocity profiles for the creek and the river for remedial scenarios. While post-remediation restoration design for all remedial approaches relied on "baseline" modeling results, not all of the remedial approaches required hydraulic modeling analysis with HEC-RAS to assess impact of water diversion during remediation. The specific hydraulic model simulations conducted are summarized in Table 1 along with key findings.

Two concerns related to potential placement of water diversion structures during remediation were evaluated: 1) potential flooding of work areas due to over-topping of diversion structures during wet weather events that may occur during the remediation period; and 2) potential increased flooding risk to upstream areas during high flows due to flow restriction caused by the water diversion structures. These two concerns must be balanced in designing the remediation water diversion structures. If the diversion structures are too low, the work area may be inundated too often. If the diversion structures are too high, a severe wet weather event could result in elevated flood levels upstream. To address these two concerns, two "design flows" were selected based on previous experience on other similar projects. The 2-year return flow was simulated to determine a diversion structure height that would protect against this moderate wet-weather flow event. The 25-year return flow was simulated to evaluate increased flooding potential in upstream areas. The return flows were estimated using the USGS flow records for the Kress Creek gage near Rt. 59 (USGS gage #05540060) and the West Branch DuPage River gage near Warrenville Dam (USGS gage #05540095). Gage information and a statistical summary of the daily average flows reported by USGS for these two locations are presented in Table 2. Table 3 presents the annual average and maximum daily average flows at each gage for the period of record. Estimated flow magnitudes for the 2-, 5-, 10-, 25-, 50-, 100- and 200-year return periods using the Log Pearson Type III method based on the annual maximums are presented in Table 4.

The concern related to increased flooding potential due to placement of remediation structures is mitigated by limiting the height of water diversion structures so as not to significantly exceed bank height. Once increasing flood flows overtop the river banks, water levels rise more slowly due to conveyance in the floodplain. Large floods, which are of most concern for flooding potential, overtop the river banks by up to several feet or more in numerous locations along Kress Creek and the West Branch DuPage River due to the configuration of the creek and river valley. If water diversion structures do not significantly exceed bank elevations, floodplain conveyance is not expected to be significantly affected. Once the diversion structures are over-topped, the floodplain could accommodate additional flow resulting in limited increased flooding potential. WSE results from the models indicate that the 2-year daily average return flow for Kress Creek (~204 cubic feet per second [cfs]) and the West Branch DuPage River at Warrenville Dam (~1,090 cfs) is approximate to, or slightly larger than, the bank-full flow for most locations. Figure 2 shows the 2-year flow WSE profile versus tope of bank elevations for Kress Creek. This suggests that designing water diversion structures to protect against this flow magnitude would be unlikely to result in significantly increased flooding potential.

An evaluation of the 2-year flow exceedence was conducted to assess risk of flooding of work areas during remediation. The time series flow records available for the USGS gage on Kress Creek are shown versus the estimated 2-year return flow of 204 cfs on Figure 3. The number of events exceeding 204 cfs at the Kress Creek gage during the months March through October for this approximately 15-year period was determined. A total of ten events exceeding 204 cfs were experienced over an eight-year period during the months March through October. Three of these events occurred in the month of April, two in May, two in June, one in July, and two in August.

Date	Flow
Aug 14, 1987	395 cfs
Aug 27, 1987	324 cfs
May 10, 1990	258 cfs
Apr 15, 1991	241 cfs
May 26, 1991	305 cfs
Jun 8, 1993	240 cfs
Jun 24, 1994	279 cfs
Apr 27, 1995	211 cfs
Jul 18, 1996	1,210 cfs
Apr 23, 1999	207 cfs

This assessment was similarly conducted for the West Branch DuPage River flows at Warrenville Dam. Figure 4 shows the available USGS flow time series at the Warrenville Dam gage versus the approximate 2-year return flow of 1,090 cfs. Over this 32-year period 19 events in 14 years experienced flows exceeding 1,090 cfs. Four of these occurred in the month of March, five in April, four in May, one in June, one in July, three in August, and one in October.

Date	Flow
Aug 26, 1972	1,760 cfs
Mar 5, 1976	1,380 cfs
Mar 5, 1979	1,150 cfs
Mar 19, 1979	1,410 cfs
Apr 12, 1979	1,150 cfs
Apr 3, 1983	1,580 cfs
Mar 5, 1985	1,400 cfs
Aug 15, 1987	2,880 cfs
Aug 27, 1987	1,900 cfs
May 10, 1990	1,400 cfs
May 26, 1991	1,240 cfs
Jun 25, 1994	1,400 cfs
Apr 27, 1995	1,140 cfs
May 29, 1996	1,190 cfs
Jul 18, 1996	2,870 cfs
May 8, 1998	1,420 cfs
Oct 18, 1998	1,210 cfs
Apr 23, 1999	1,500 cfs
Apr 21, 2000	1,480 cfs

This information provides an indication of the probability of flooding of remediation work areas due to occurrence of a flow equal to or larger than the 2-year flood flow if water diversion structures are designed based on this flow.

Simulations of the 2-year flood flow and 25-year flood flow for baseline conditions and remediation conditions (with diversion structures in place) are presented below. In addition to being used to assess increased flooding potential, downstream velocity profiles from the 25-year flood simulation were used to estimate velocity ranges for channel restoration design. Selection of this flow as a basis for restoration design is supported by the observation that, for larger flows, predicted channel velocities do not increase much above those for the 25-year flow due to flood plain conveyance.

3. "Baseline" Conditions

The DuPage DEC FEQ models of Kress Creek and the West Branch DuPage River were used to simulate baseline conditions for the following purposes:

- To estimate WSE and channel velocities to aid in channel restoration design;
- To determine stage-discharge rating curves for use at the HEC-RAS boundaries;
- For comparison to HEC-RAS model WSE results;
- To estimate tributary contribution as a percent of total flow in each channel; and
- To assess flow routing around the islands and past Warrenville Dam during flood flows.

Channel velocities computed for baseline conditions provide useful information for post-remediation conditions under the assumption that the restored river channels would have equal or larger cross-sectional area and no significant change in bottom slope. Based on this assumption, post-remediation in-stream velocities and elevations will be similar to or lower than current conditions. Actual post-remediation cross sections in most areas are likely to have somewhat larger cross-sectional area than baseline conditions. The FEQ results thus provide appropriate conservative predictions for post-remediation channel restoration design that will withstand flood flows because computed velocities would tend to be higher than they would be if actual post-remediation cross sections were simulated. The FEQ model output includes a determination of peak flow velocities (averaged across the channel) for each high flow event in the simulation period. The FEQ and HEC-RAS model results for the 25-year return flow in the creek and the river were used to specify velocity ranges for use in conceptual design of channel restoration measures.

The DuPage DEC provided an FEQ input deck for Kress Creek to simulate the period 1925 through 1993. Two input decks were provided for the West Branch DuPage River, one for simulating the period 1985 to 1996 and another simulating the period of the 1996 flood. Only the 1996 flood simulation was operable for the West Branch DuPage River model due to omission of required files for simulating the earlier period in the DuPage DEC transmittal. The West Branch DuPage River model includes a portion of Kress Creek, so although an input deck for Kress Creek was not provided for this event, 1996 results were obtained for a portion of the creek upstream from the confluence from the river model. For Kress Creek, the years 1990 and 1987 were also selected for simulation. Results are discussed in detail below.

On average, Kress Creek flow at Rt. 59 is about 17% of West Branch DuPage River flows recorded by the USGS gage near Warrenville. FEQ model results for the 1996 flood event, the highest contained in the USGS gage records for Kress Creek and the West Branch DuPage River, were used to estimate tributary contributions between Roosevelt Road and Warrenville Dam. Results are shown below for specific river stations as a percentage of the total flow just upstream of Warrenville Dam.

Station	Percent of Flow at Warrenville Dam
Roosevelt Road bridge	47%
Gary's Mill Road bridge	48%
Kress Creek Confluence	79%
Mack Road bridge	83%
William Road bridge	85%
Cenacle bridge	85%
Spring Brook Confluence	99%

Average West Branch DuPage River flow over the event approximately doubles between Roosevelt Road and Warrenville Dam. Approximately 60% of this increase is from Kress Creek and the majority of the additional increase from Spring Brook. Other tributaries in this reach are minor in comparison. FEQ results for the 1990 Kress Creek simulation were similarly used to assess tributary contributions to Kress Creek downstream of the EJ&E RR, shown below.

Station	Percent of Flow at Rt. 59
EJ&E RR	89%
May Street bridge	96%
Joy Road bridge	96%
Wilson Road bridge	99%
Rt. 59 bridge	100%

These results show that on average, only about 10% of the flow past Rt. 59 enters Kress Creek downstream of the EJ&E RR. Nearly 90% of the flow past Rt. 59 originates upstream of the EJ&E RR.

The flow percentages for the Kress Creek and West Branch DuPage River stations presented above were used to apportion flows along the creek and the river in the HEC-RAS model.

Upstream and downstream boundary conditions for HEC-RAS were described by rating curves developed from FEQ output. The HEC-RAS input rating curves for the upstream and downstream HEC-RAS boundaries on West Branch DuPage River are described by the FEQ-computed rating curves presented on Figure 5.

The HEC-RAS model results were checked against the FEQ model results for a range of flow conditions to ensure reasonable performance. The HEC-RAS model produced very comparable results to the FEQ model, as expected using similar inputs for both models. Typically, water surface profiles computed by the two models differed by less than 0.5 feet and in most locations, by less than 0.2 feet. These small differences were primarily due to specification of hydraulic properties of culverts and bridges. It should be noted that the HEC-RAS was not calibrated. It was simply run with input information taken from the FEQ model. Prior to use of the model results in detailed design activities for any selected remedial approaches, the performance of both FEQ and HEC-RAS should be evaluated by comparison to measured WSE values.

3.1 Kress Creek Baseline WSE and Velocity Results

Downstream water surface elevation profiles computed by FEQ were extracted from the year 1990 simulation results for flow magnitudes at Rt. 59 ranging from the daily average flow of 16 cfs to the peak flow recorded in 1990, 510 cfs (Figure 6). The thalweg elevation (minimum stream bottom elevation in the cross-section) is also shown on Figure 6. Results show that the WSE profile in Gunness Lake between the May Street and Joy Road culverts is nearly level for the range of flows represented. Water elevations in Gunness Lake are controlled by the Joy Road culvert, whereas in most other sections of the creek, water surface slopes reflect bed slope and channel resistance to flow. This suggests that placement of water diversion structures in Gunness Lake will not appreciably affect lake water levels. For average flow conditions, maximum water depth is about 2 feet, which occurs in Gunness Lake. For the maximum flow in 1990, the maximum water depth of about 7.3 feet also occurs in Gunness Lake. Downstream water depths range from about 2.5 to 6 feet for the 510 cfs flow. Flow depth generally increases by about 2 to 4 feet downstream of Gunness Lake for an increase in flow from the daily average of 16 cfs to the 1990 maximum daily flow of 510 cfs.

Flow rating curves at several of the potential pump bypass locations on Kress Creek were prepared from FEQ baseline simulation results. These are shown on Figure 7 for May Street, Joy Road, Wilson/Joliet Road, and Rt. 59. These results provide a guide for berm heights used to form pumping pools for pump bypass alternatives.

Figure 8 shows channel velocities computed by FEQ for high flow events in 1990, 1987 and 1996 (for downstream of Wilson Road only). Peak event velocities range from about 0.7 ft/sec in Gunness Lake to 7.5 ft/sec just downstream of Joy Road. Velocities slow upstream of the Wilson Road bridge and the Rt. 59 bridge and accelerate just downstream. Downstream of Wilson Road peak event velocities may exceed 6 ft/sec in a narrow portion of the channel. These velocities are average velocities and in river bends, near-bank velocities could be higher. Detailed design should account for high erosive forces during flood flows in these areas.

3.2 West Branch DuPage River Baseline WSE and Velocity Results

Downstream WSE profiles for the West Branch DuPage River computed by FEQ were extracted from the year 1996 simulation results for flow magnitudes at Warrenville Dam ranging from the daily average flow of 60 cfs to the peak instantaneous flow computed by FEQ at Warrenville Dam of 4,222 cfs in 1996 (Figure 9). The peak flow of 4,222 cfs is the highest flow on record. The thalweg elevation is also shown on this figure. At daily average flow, maximum water depth ranges from approximately 1 foot near Mack Road to about 5.5 feet near the Cenacle bridge, which is in the backwater from Warrenville Dam. At average flow, the backwater extends to Williams Road. As flows increase, the backwater effect of Warrenville Dam diminishes considerably. On average, the annual maximum flow recorded at Warrenville Dam is about 1,200 cfs. At this flow, maximum depth increases over average depth from about 2.5 to 4 feet between Roosevelt Road and Warrenville Dam.

Flow rating curves at several potential pump bypass locations on the West Branch DuPage River were prepared from FEQ baseline simulation results. These are shown on Figure 10 for Gary's Mill Road, the confluence with Kress Creek, Mack Road, and Williams Road.

In the West Branch DuPage River, channel velocities for the 25-year flow ranged from about 1.2 to 2.5 feet per second (ft/s) outside of bridge sections. In bridge sections, velocities are somewhat higher, although these areas would not be affected by remediation. Evaluation of velocities computed by FEQ for the 2-year flow and the highest flow on record (the 1996 flood) shows that the range of channel velocities in the River are not appreciably different from the 25-year flow HEC-RAS result (Figure 11).

4. Effects of Water Diversion Structures on Flow Conditions

The effect of water diversion structures placed during remediation on WSE was evaluated with the steady-state HEC-RAS model for the proposed remedial approach for each reach listed below and previously summarized in Table 1.

- Reach 1: Excavation performed through the use of dewatering, including sheetpile near railroad/outfall area and pump bypass.
- Reach 2: Excavation performed through the use of dewatering, including sheetpile around the northwest lake area and pump bypass.

- Reach 3: Excavation performed through the use of dewatering, including use of berms and pump bypass.
- Reach 4: Excavation performed through the use of dewatering, with berms at Route 59/confluence and pump bypass.
- Reach 5: Excavation performed through the use of dewatering, including use of sheetpile and pump bypass (stretch from STP outfall to Gary's Mill Road excavated through the use of turbidity barriers or sand bags).
- Reach 6: Excavation performed through the use of dewatering, with sheetpile around each removal area (except turbidity barriers or sand bags for water diversion around smaller west shore and upstream areas).
- Reach 7: Excavation performed through the use of dewatering, using sheetpile to divert flow.

Water diversion structures required for each reach were represented in the model as a constriction of the cross-section by placing a vertical wall or weir of specific height at the location of diversion structure placement. For the sheetpile diversions that may be placed alongshore, the vertical walls represent a narrowing of the channel. For the diversion wall structure for Warrenville Lake, a berm or weir positioned across the channel was simulated. This would likely be a driven sheetpile wall.

4.1 Shoreline Sheetpile or Sandbagging for West Branch DuPage River

The evaluation of WSE impacts in the West Branch DuPage River used the ineffective-flow-area approach in HEC-RAS. The ineffective flow area tool allows the user to specify the location of floodway structures, such as a sheetpile wall, along a river cross-section. These are represented as vertical walls constricting flow to the portion of the channel between the walls. The increase in WSE for flood flows compared to base flow can then be analyzed. Once the WSE exceeds the wall height, the cross-section fills to accommodate flood flow. This represents flooding of the work areas that would occur during large floods on the West Branch DuPage River. An example of cross-section modification using this to simulate placement of remediation structures is illustrated on Figure 12 for a cross-section on the West Branch DuPage River.

Representative cross-sections from four sections of the river were used to assess placement of sheetpile along the banks 5 feet toward the center of the river from the top of bank location, to a height approximately 2 feet above the top of the bank. The evaluation for the river was conducted for eight cross-sections in the areas presented below from four river sections between Kress Creek and the islands in Warrenville Lake.

Station	Location
41.707	Between the Kress Creek Confluence and Mack Road
41.506	
41.334	
40.475	Between Mack Road and Williams Road
40.36	
40.25	
39.938	Between Williams Road and the Cenacle
39.587	Between the Cenacle and Butterfield Road

Placement of bank sheeting diversion at the following locations was simulated to assess effects on the 2-year flood WSE and the 25-year flood WSE. Results suggest that 2-year flood elevations will be affected by only a few inches or less in most areas (Figure 13). Therefore, placement of diversion walls 2 feet above the top of the bank should be sufficient to protect flooding during the 2-year event with minimal impacts to flood stage. Flooding potential was further assessed by comparing 25-year flood WSE profiles for baseline conditions and with the water diversions installed. Results show negligible increases in WSE. This is primarily because the diversion structure is overtopped in the simulation and the entire cross-sectional area is available to accommodate flow. This analysis does not take into account potential damming effects of where diversion structures run in towards the banks, however, this factor would be less important once the bank elevations are overtopped, as would occur in a 25-year flow event.

4.2 Diversion around Warrenville Lake Islands

Water diversion around the islands in Warrenville Lake was simulated by placement of a low-head weir across the upstream end of the channel on each side of the islands. Inspection of channel plan view orientation suggests that the majority of the flow would be carried in the right side channel of the north island and the left side channel of the south island. Evaluation of FEQ results shows that about 57 to 61% of the flow is carried by the right channel around the north island and about 60 to 66% of the flow is carried by the left channel around the south island.

Flow diversion would increase flow in the channels above that which would be experienced normally, leading to higher velocities and potential concerns related to channel scour and downstream transport of sediments as the first side is being remediated. To evaluate this concern, a simulation was conducted assuming all of the flow for a 2-year and 25-year flood would be diverted down the channel normally carrying the lowest percentage of the flow, namely the left side channel around the north island and the right side channel around the south island.

With all of the flood flow diverted down the left channel around the north islands, maximum channel cross-section velocities for the 25-year flood increase from a range of about 1.7 ft/sec for baseline conditions to a maximum of 4.5 ft/sec for flow diverted to the left channel. For the 2-year flood, left channel velocities increase from about 0.8 ft/sec for baseline conditions to a maximum of about 2.7 ft/sec for flow diverted to the left channel. Predicted flood stage increased by about 1.2 feet for the 25-year flow in for complete diversion around the north island through this channel.

Diverting all of the water through the right channel of the south island was similarly evaluated. This would increase velocities from a maximum cross-section velocity of about 0.7 ft/sec and 1.2 ft/sec for baseline conditions to about 2.0 and 3.4 ft/sec for the 2-year and 25-year flows, respectively. Predicted flood stage increased by about 0.6 feet for the 25-year flow in for complete diversion around the south island through this channel.

To mitigate concerns associated with increased erosion potential, a berm was simulated by simply blocking out a portion of the upstream cross-section in each affected channel to form the water diversion around the islands. Analogous to the approach used for simulating WSE impacts due to placement of water diversion along the banks upstream, the WSE of the 2-year flood was used to set the berm height. The berm height was limited to 0.5 feet higher than the 2-year flood stage so it would overflow during high flow events. Simulation of the 25-year flow with the berm in place was conducted and channel velocities and WSE on both sides of the islands compared to baseline velocities.

With the berm simulated, maximum cross-section velocities in the left and right channels around the north island were 1.7 ft/sec and 1.5 ft/sec, respectively. Simulating water overflowing the berm during the 25-year flow reduced velocities in the left channel by approximately 2.8 ft/sec compared to diverting all the flow through the left channel. No significant increase in flood WSE occurred compared to baseline 25-year flow results.

With the berm simulated, maximum cross-section velocities in the left and right channels around the south island were 1.0 ft/sec and 1.9 ft/sec, respectively. Allowing water to overflow the berm during the 25-year flow reduced velocities in the right channel by approximately 1.5 ft/sec compared to diverting all the flow through the right channel. No significant increase in flood WSE occurred compared to baseline 25-year flow results.

Actual impacts of diversion berm or sheetpile wall placement would depend on actual placement, the characteristics of the overflow structure (e.g., berm spillway or sheetpile weir), and top elevation of the overflow structure. The simple analysis presented above shows that it is feasible to divert water around the islands to prevent flooding by a 2-year return flow and minimize increased flooding potential from higher flows, such as the 25-year return flow. These simple simulations assumed a sandbag berm would be placed across the river to form the diversion wall. Placement of a sheetpile weir would slightly reduce flooding potential by increasing conveyance over the weir as compared to a sandbag berm during an overflow event.

4.3 Placement of Low Berms or Sheetpile Walls Across the Channel for Pump Bypass

For pump bypass alternatives in Reaches 1 through 5, a low sandbag berm or sheetpile wall would be placed across the channel at select locations in Kress Creek and the West Branch DuPage River and a small pump pool established just upstream of the berm. Water pumped from the pump pool would be bypassed in pipes around the creek or river section being remediated and discharged downstream of it. The pump systems would be designed to accommodate a flow in Kress Creek and the West Branch DuPage River approximately equal to the maximum monthly average. The berms placed to form the pump pool would be low berms of sufficient height to contain this flow and would act as low head weirs for larger flows until they were completely submerged. Weirs were simulated at the following locations on Kress Creek: just upstream of May Street; just upstream of Joy Road; just upstream of Wilson Road; just upstream and downstream of the Nichiren Shoshu Temple; and just upstream of Rt. 59. On the West Branch DuPage River, weirs were simulated just downstream of Gary's Mill Road, just downstream of the Kress Creek confluence, just upstream of Mack Road, near Emerald Green, and just upstream of Williams Road.

The potential for increased flood WSE upstream of the pump pool berms or sheetpile walls was assessed by inserting weirs in HEC-RAS at pump bypass locations and then simulating the 2-year and 25-year flood flows and comparing flood WSE results to baseline flood results. Weir elevations were conservatively specified based on computed WSE for the 1-year flood flow, or 1-foot below bank elevation, whichever was smaller. For most pump bypass locations, the 1-year flood flow WSE was more than 1 foot below the top of bank. In a few locations, the 1-year flood flow was slightly less than 1 foot below the top of bank. If the pumps are active, WSE should not rise to the level of the 1-year flood WSE for baseline conditions, even if the 1-year flood should occur because the pumps would keep the level drawn down. However, sizing the weir height based on the 1-year flood flow provides a conservatively large potential impact to flood WSE in upstream areas. Limiting the pump bypass weir elevation to equal to or less than 1 foot below the top of bank elevation tends to reduce potential elevation of upstream WSE during floods, yet still provides a reasonable (and conservative) assumption for required weir height to contain the 1-year flood flow for bypass pumping.

Results show that the low weirs generally would become submerged at flows approximate to the 2-year flood flow and that WSE in the vicinity of the weir would then tend to be controlled by flow resistance due to the floodplains and channel constrictions downstream. Model results indicate that low-head berms sized on the maximum monthly average flow will allow pump bypassing with only minor increases in flood WSE for all bypass locations simulated. For the 25-year flood simulation, WSE increased by a maximum of a few inches.

Tables

Table 1

Summary of Hydraulic Model Simulations for Evaluation of Remedial Alternatives

Conceptual Design Report
Kerr-McGee Chemical LLC
Kress Creek/West Branch DuPage River Site
DuPage County, Illinois

Reach	Model Simulations[1]	Findings of Evaluation of the Remedial Approach for Each Reach
Reach 1: Outfall to May Street (Kress Creek):	Simulation of 2-year and 25-year flood with sheetpile installed near the rail road and outfall area.	Bank sheeting will have minimal effect on WSE for 2-year and 25-year floods if sheeting height is limited to just above the 2-year flood elevation.
	FEQ simulation of baseline conditions to determine rating curves at EJ&E RR and May Street for temporary berm installation for pump bypass.	Rating curves provide information on required berm height to contain 2-year flow while minimizing increased flood potential for larger floods.
Reach 2: May Street to Joy Road (Gunness Lake on Kress Creek):	Simulation of 2-year and 25-year flood with bank sheeting around northwest lake area and pump bypass.	Flood flows would overtop the pump bypass berm at May St. and fill Gunness Lake. WSE in Gunness Lake at 25-year flow show minimal effects due to bank sheeting.
Reach 3: Joy Road to Route 59 (Kress Creek)	FEQ simulation of baseline conditions to determine rating curves for evaluation of pump bypass.	Rating curves provide information on required berm height for pump bypass options.
	Simulate temporary pump bypass berms at Joy Road and Williams Road	Placement of a low weir to form pump bypass pools for pump capacity capable of 1-year return flow will have minimal effects on upstream flood WSE.
Reach 4: Route 59 to Confluence (Kress Creek)	Simulate pump bypass berms at Rt. 59 and upstream and downstream of the temple.	Placement of a low weir to form pump bypass pools for pump capacity capable of 1-year return flow will have minimal effects on flood WSE.
Reach 5: STP Outfall to Williams Road (West Branch DuPage River)	Simulate pump bypass berms at Gary's Mill Road, the confluence of Kress Creek, Mack Road, near Emerald Green, and just upstream of Williams Road.	Placement of a low weir to form pump bypass pools for pump capacity capable of 1-year return flow will have minimal effects on flood WSE.
Reach 6: Williams Road to Butterfield Road (West Branch DuPage River)	Simulation of 2-year and 25-year flood with near-bank sheetpile installed for diversion of water around remediation areas. Simulated representative cross sections.	Placement of diversions structures along the toe of the banks to a height of about 1 to 2.5 feet above the top of bank elevation would be required for bank areas with a floodplain, depending on bank elevations, to protect remediation areas from flooding during a 2-year flood flow. Limiting bank diversion structures to these heights so that larger floods would over-top them, should result in minimal increased flooding potential at the 25-year flood flow.
Reach 7: Butterfield Road to Warrenville Dam (West Branch DuPage River)	Simulation of water diversion down the smallest side channel of each island (left channel around north island and right channel around south island). Simulation was conducted for total diversion and diversion with a berm or weir that would overflow during floods larger than the 2-year flood. Impacts of water diversion on WSE and channel velocity were assessed.	Total water diversion around either channel through the smallest channel represents a worst-case impact on flood potential and channel scour potential. Predicted flood WSE increased up to 0.8 feet in the channels for total diversion and velocity increased.

Note:
1. Baseline simulations were conducted for all reaches with the FEQ model. Baseline results provide information on downstream velocity profiles, and water surface elevations for restoration design. Also, baseline results from FEQ were used to determine stage-discharge rating curves for assessing pump bypass alternatives.

Table 2

Statistical Summary of Daily Average Flows
Recorded by USGS for Period of Record for West Branch DuPage River Gage near Warrenville Dam and Kress Creek Gage near Rt. 59

Conceptual Design Report
Kerr-McGee Chemical LLC
Kress Creek/West Branch DuPage River Site
DuPage County, Illinois

	Kress Creek	West Branch DuPage River
USGS Gage #	5540060	5540095
Gage Drainage Area (sq. mi.)	18.10	90.40
Period	11/1985 - 9/2000	10/1968 - 9/2000
Count	5,441	11,688
Minimum (cfs)	0.04	7.80
Maximum (cfs)	1,210.00	2,880.00
Average (cfs)	16.16	106.64
Median (cfs)	7.80	60.00

Monthly Statistics				
Month	Kress Creek		West Branch DuPage River	
	Average (cfs)	Maximum (cfs)	Average (cfs)	Maximum (cfs)
Jan	15.1	216	87.2	1,510
Feb	18.7	432	109.7	2,310
Mar	21.9	197	157.0	1,410
Apr	26.5	241	185.6	1,580
May	20.6	305	137.3	1,420
Jun	18.4	279	113.0	1,400
Jul	13.2	1,210	77.8	2,870
Aug	11.9	395	88.8	2,880
Sep	7.5	161	72.9	743
Oct	9.2	190	63.3	1,210
Nov	17.6	262	91.8	1,220
Dec	13.4	92	96.8	1,880

Table 3

Annual Average and Maximum Daily Average Flows
Recorded by USGS for Period of Record for West Branch DuPage River Gage near Warrenville Dam and Kress Creek Gage near Rt. 59

Conceptual Design Report
Kerr-McGee Chemical LLC
Kress Creek/West Branch DuPage River Site
DuPage County, Illinois

West Branch DuPage River, gage # 5540095			Kress Creek, gage # 5540060		
Year	Average (cfs)	Max (cfs)	Year	Average (cfs)	Max (cfs)
1968	49	350	1985	38	262
1969	82	588	1986	11	114
1970	106	869	1987	20	395
1971	42	596	1988	11	146
1972	145	1,760	1989	8	112
1973	114	872	1990	20	258
1974	120	1,060	1991	19	305
1975	101	1,000	1992	11	98
1976	80	1,380	1993	22	240
1977	47	266	1994	15	303
1978	98	743	1995	21	216
1979	149	1,410	1996	20	1,210
1980	101	673	1997	12	432
1981	93	927	1998	19	190
1982	124	1,880	1999	18	207
1983	131	1,580	2000	11	174
1984	96	1,080			
1985	109	1,400			
1986	80	625			
1987	121	2,880			
1988	80	752			
1989	70	632			
1990	135	1,400			
1991	126	1,240			
1992	85	626			
1993	148	883			
1994	106	1,430			
1995	128	1,140			
1996	121	2,870			
1997	109	2,310			
1998	140	1,420			
1999	135	1,510			
2000	105	1,480			

Table 4

USGS Gage Data for West Branch DuPage River near Warrenville Dam and Kress Creek near Rt. 59

Conceptual Design Report
Kerr-McGee Chemical LLC
Kress Creek/West Branch, DuPage River Site
DuPage County, Illinois

Return Period (years)	DuPage River USGS Gage #5540095 Flow (cfs)	Kress Creek USGS Gage #5540060 Flow (cfs)
1	257	104
2	1,090	204
5	1,668	362
10	2,042	535
25	2,499	872
50	2,826	1,245
100	3,139	1,707
200	3,444	2,488

Figures

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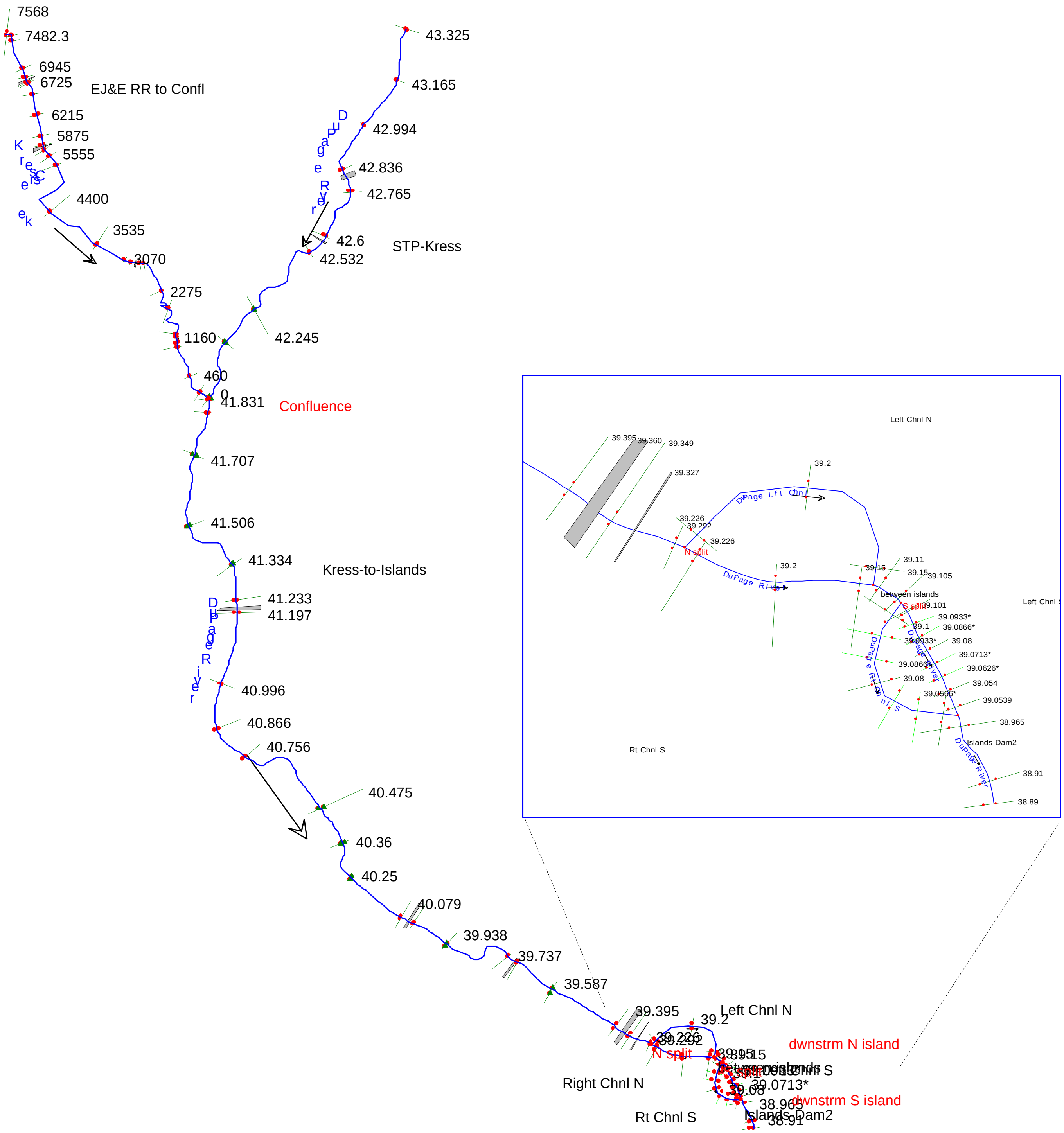

Figure 1. HEC-RAS Model cross-sections and reaches used in the Kress Creek/W. Br. DuPage River model.

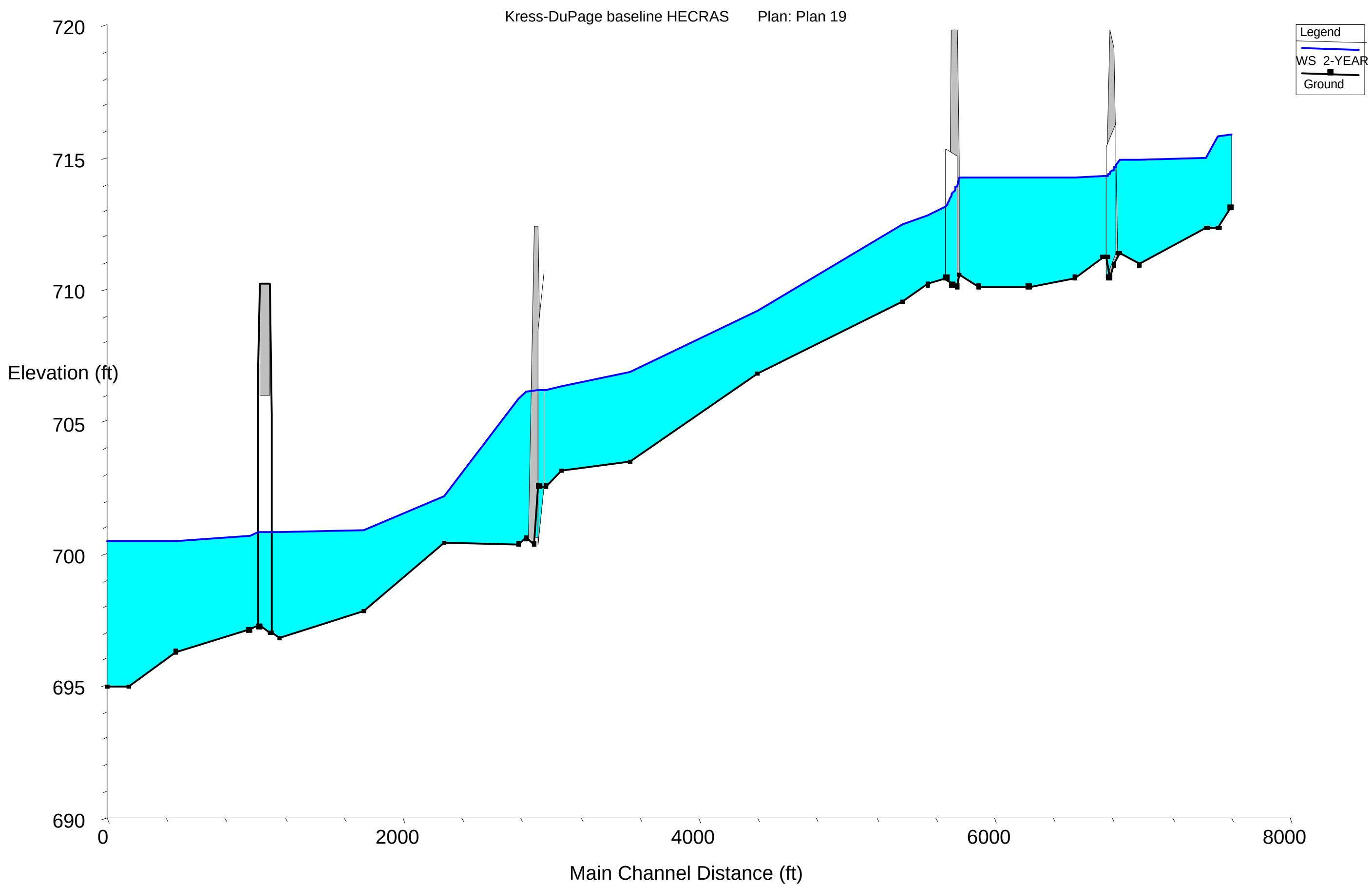

Figure 2. Baseline 2-year flow WSE results for Kress Creek.

Figure 3. Kress Creek USGS Gage #05540060 Daily Average Discharge Records at Rt. 59:1985-2000

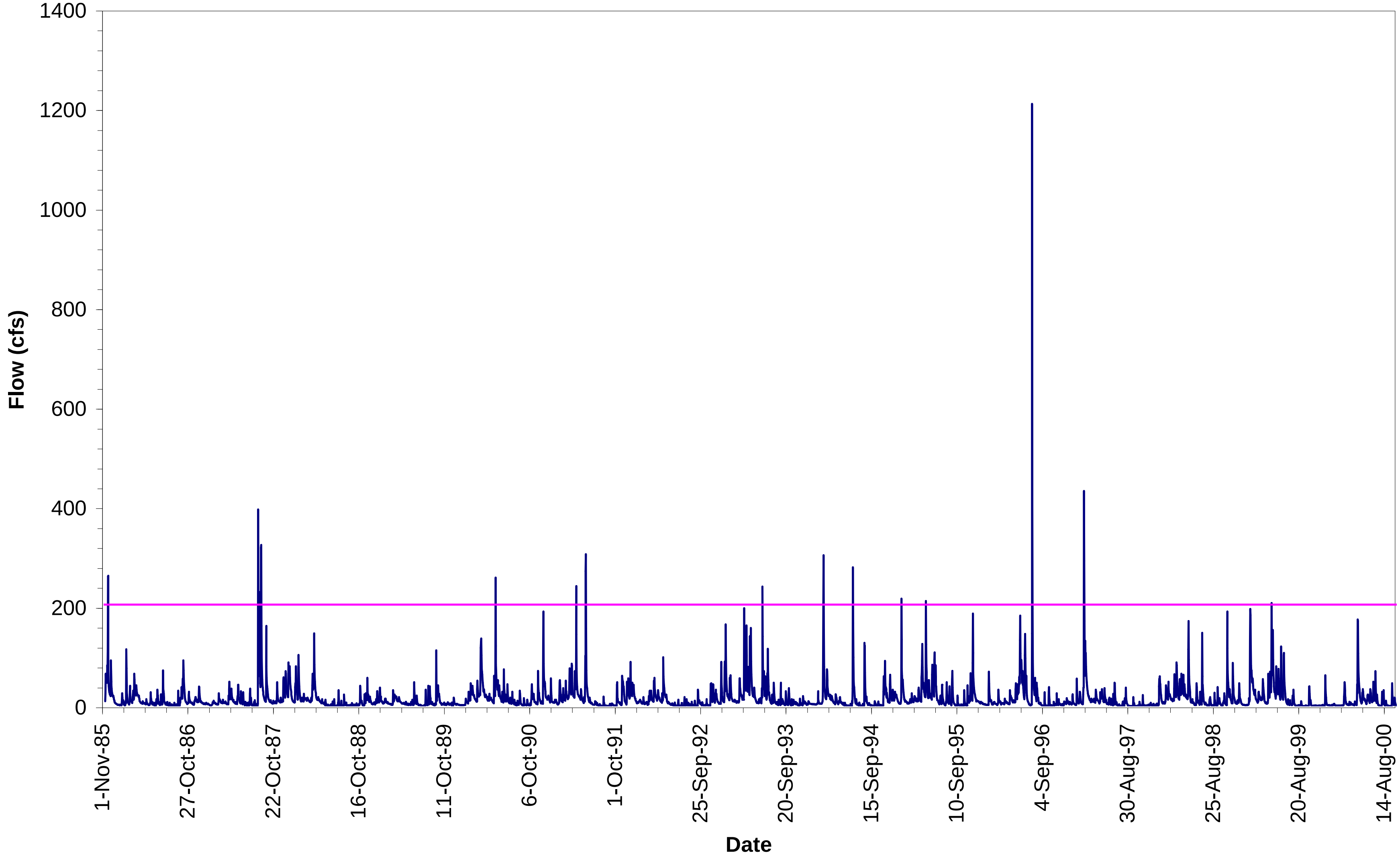

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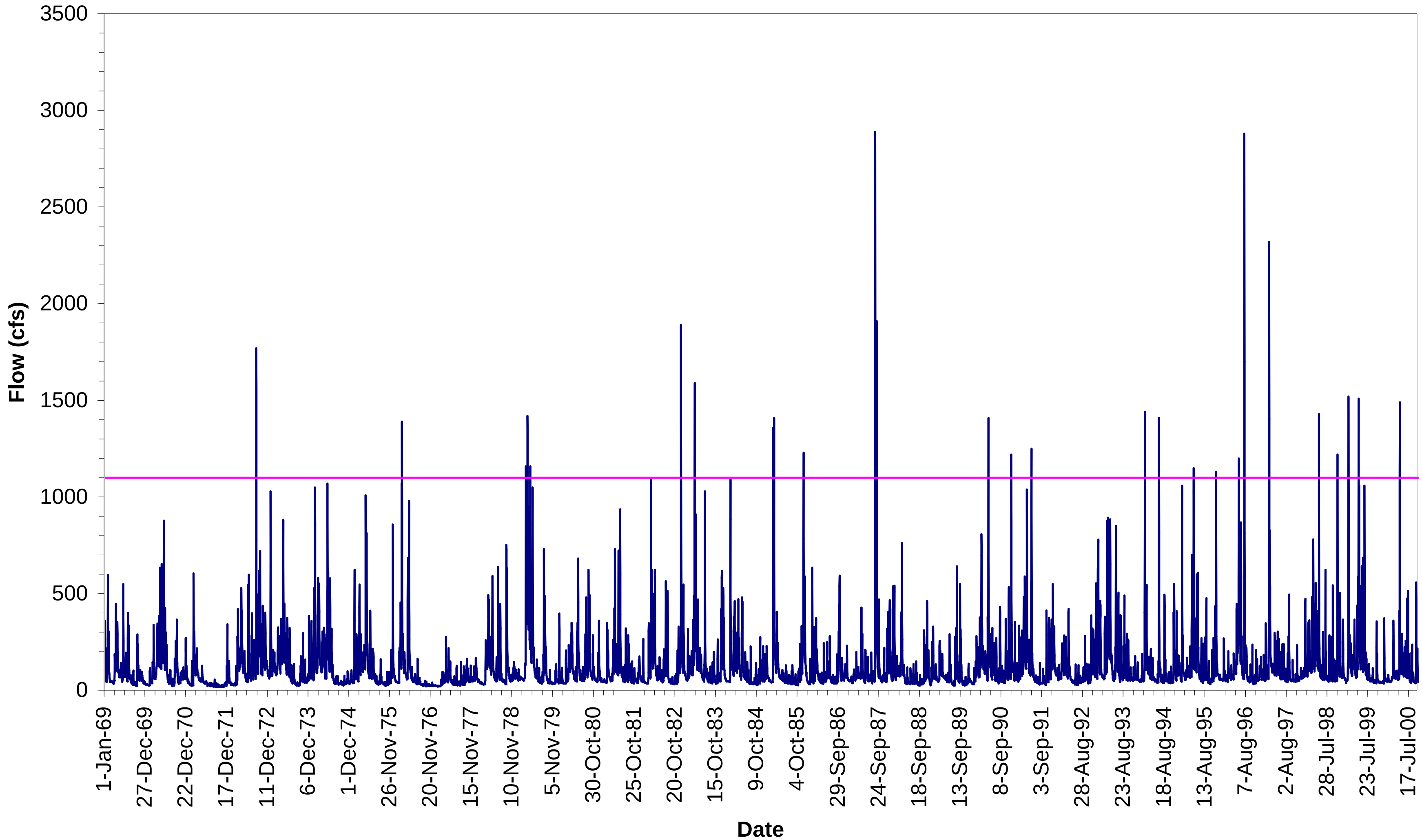
Figure 4. DuPage River USGS Gage#05540095 Daily Average Discharge Records at Warrenville Dam: 1968-2000



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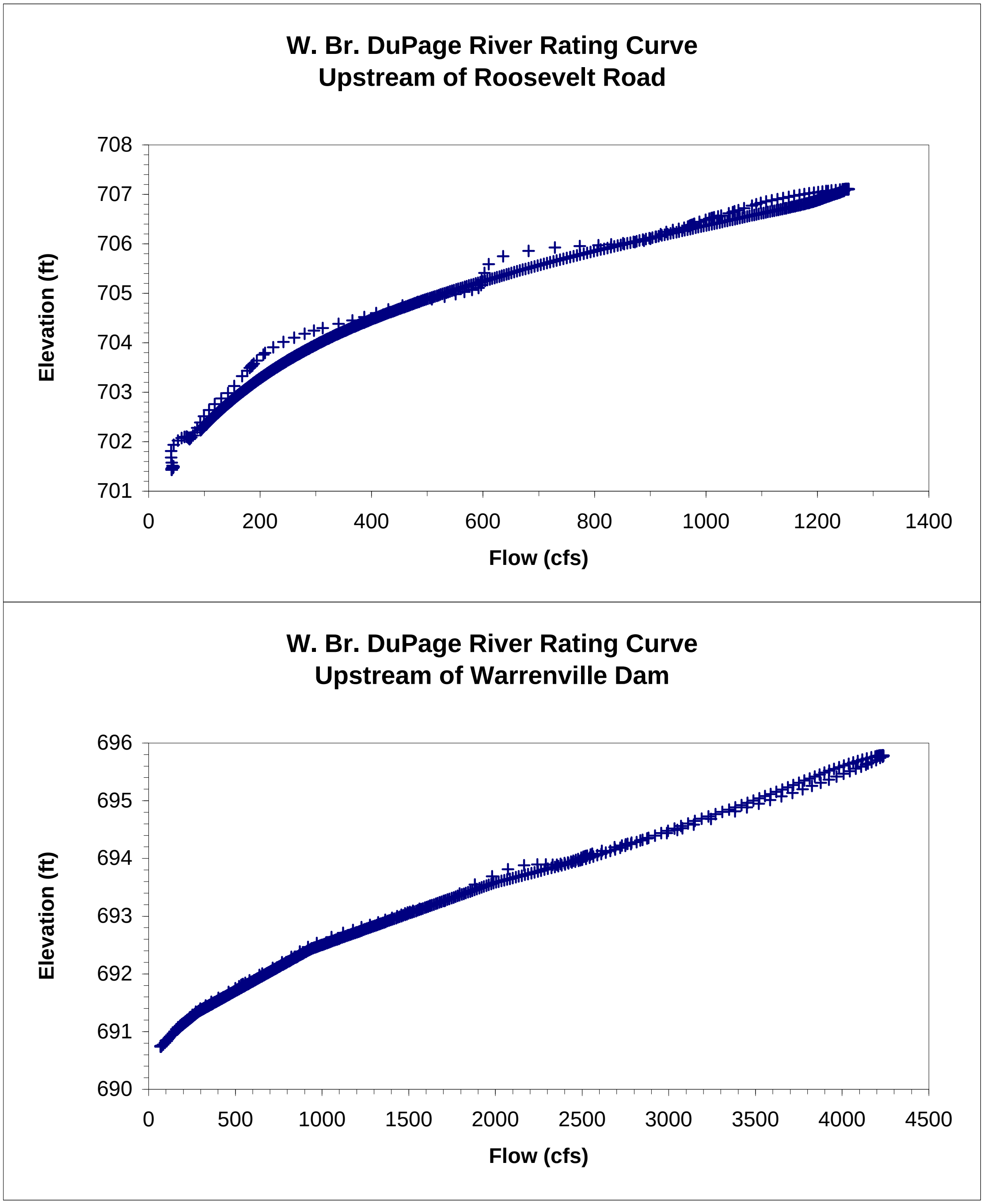
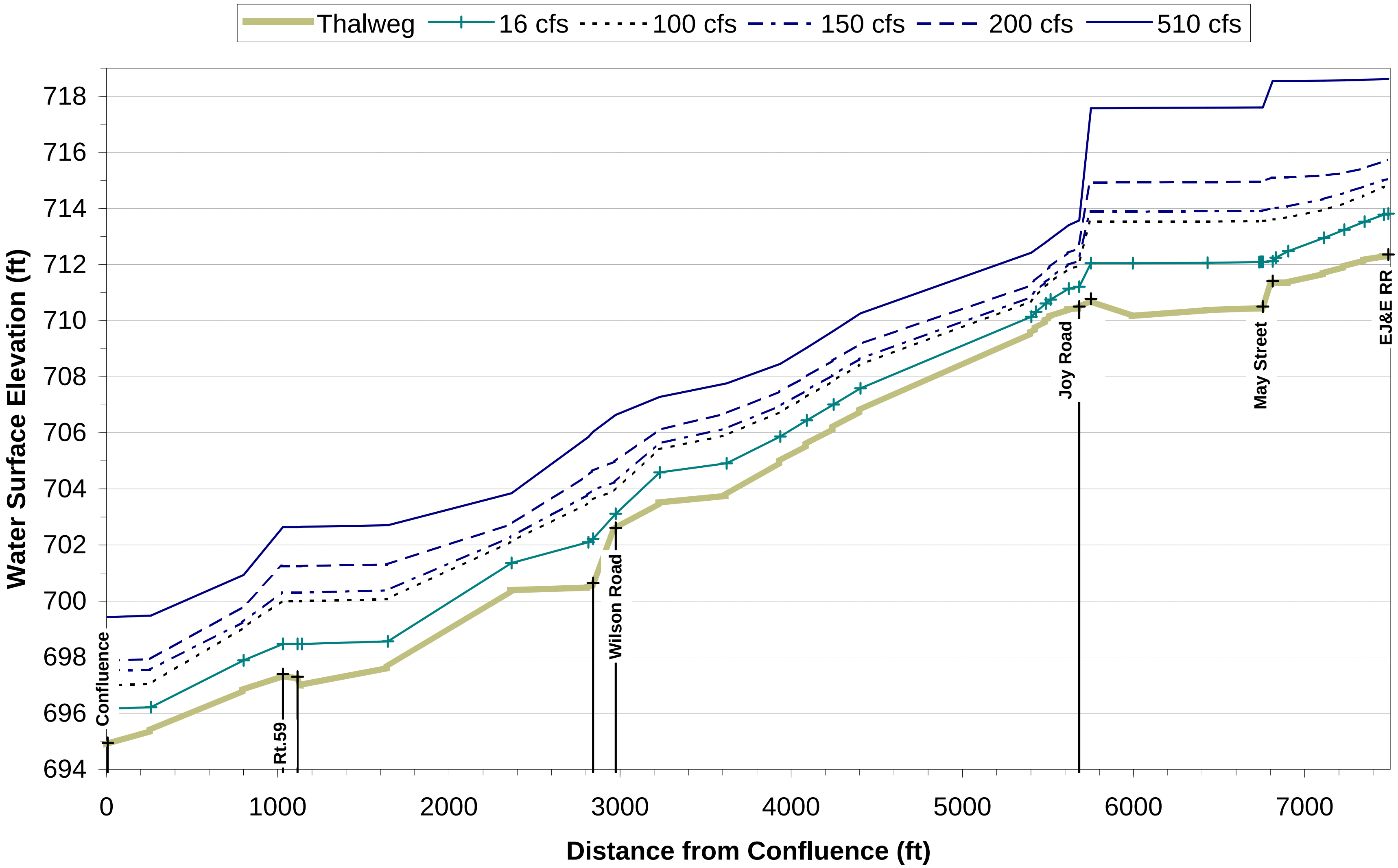


Figure 5. FEQ-computed flow rating curves used for HEC-RAS boundary conditions on the W. Br. DuPage River upstream of Roosevelt Road and just upstream of Warrenville Dam.

Figure 6. Downstream Water Elevation Profiles from Baseline Results 1990 FEQ Model Simulation.



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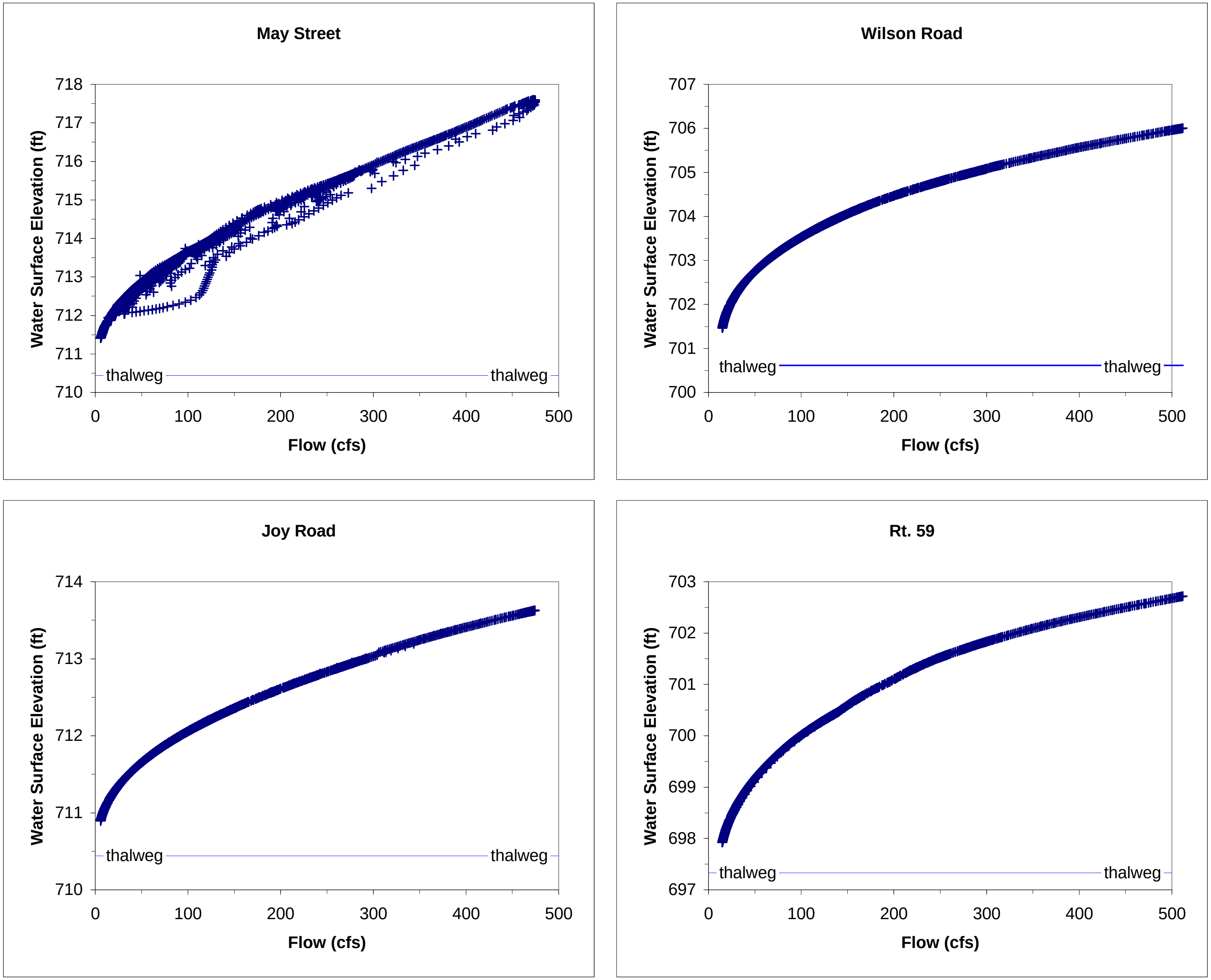


Figure 7. Stage-discharge rating curves computed by FEQ for baseline conditions at Kress Creek locations.

Figure 8. FEQ Baseline Results: Peak Event Conditions Flow at Confluence
1990 Event flows: 247, 300, 511 cfs / 1987 Event flow: 620 cfs / 1996 Event flow: 1,200 cfs

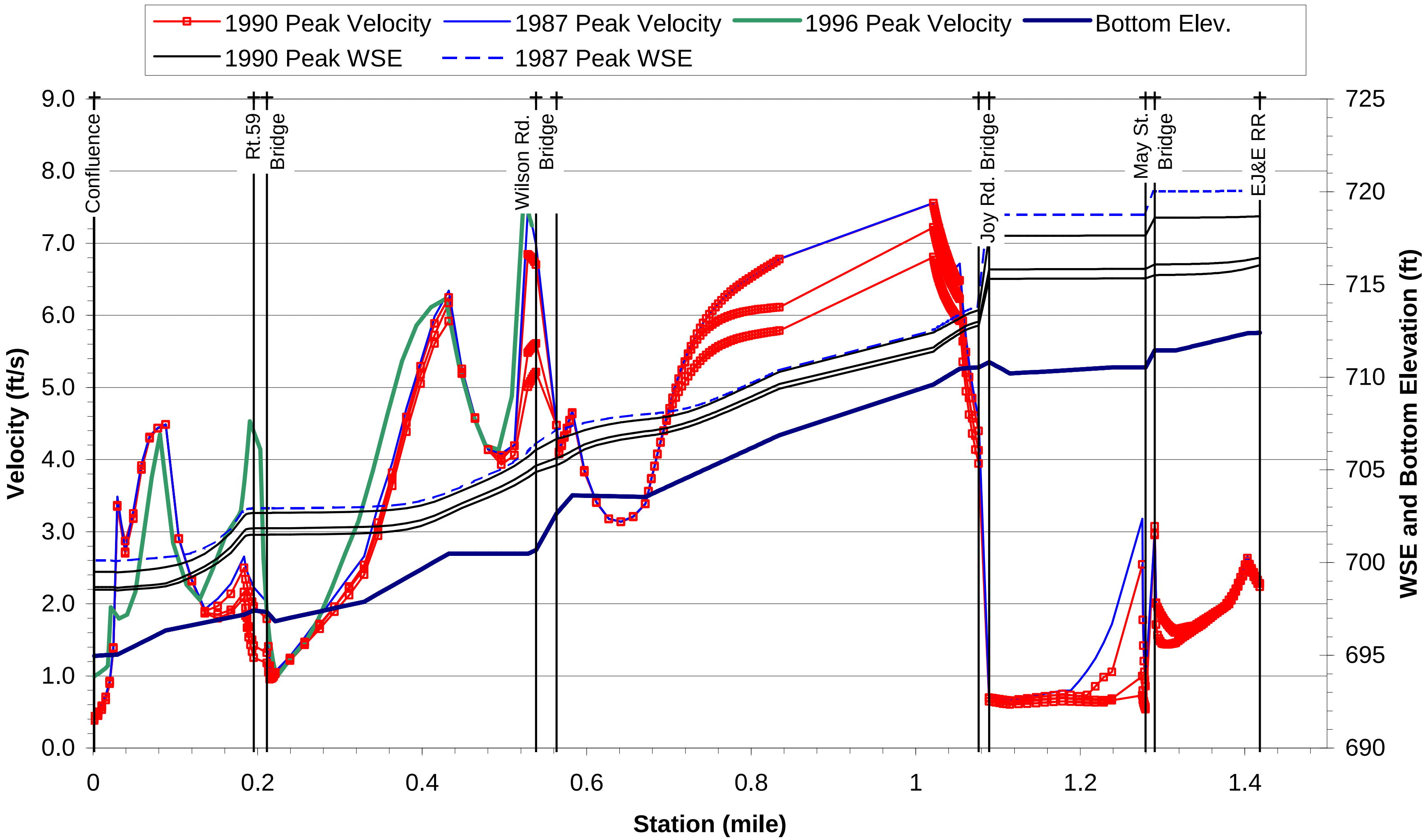
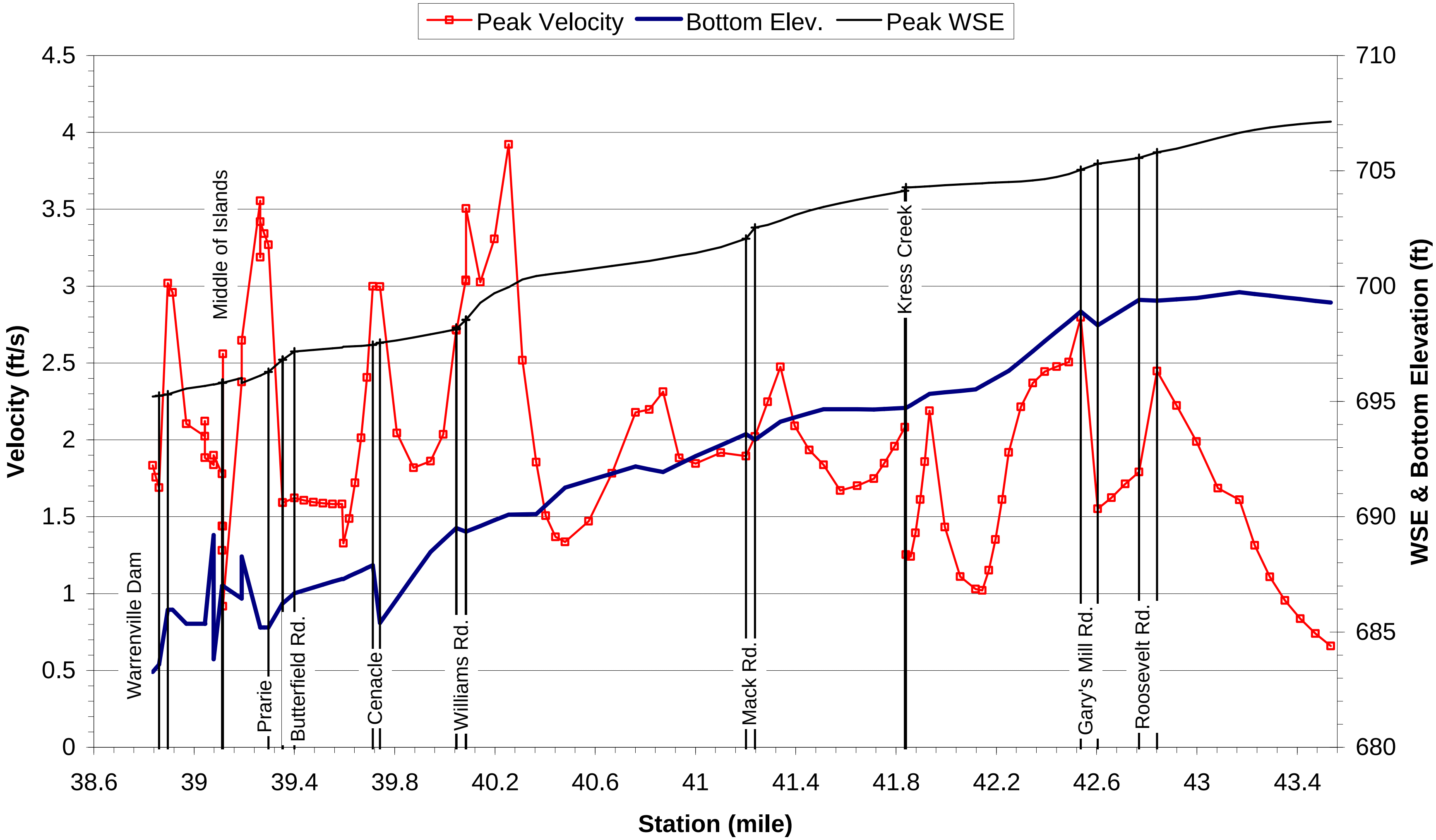


Figure 9. FEQ Baseline Results: 1996 Peak Event Conditions Roosevelt Rd. to Warrenville Dam, Peak flow at Warrenville Dam: 4,300 cfs.



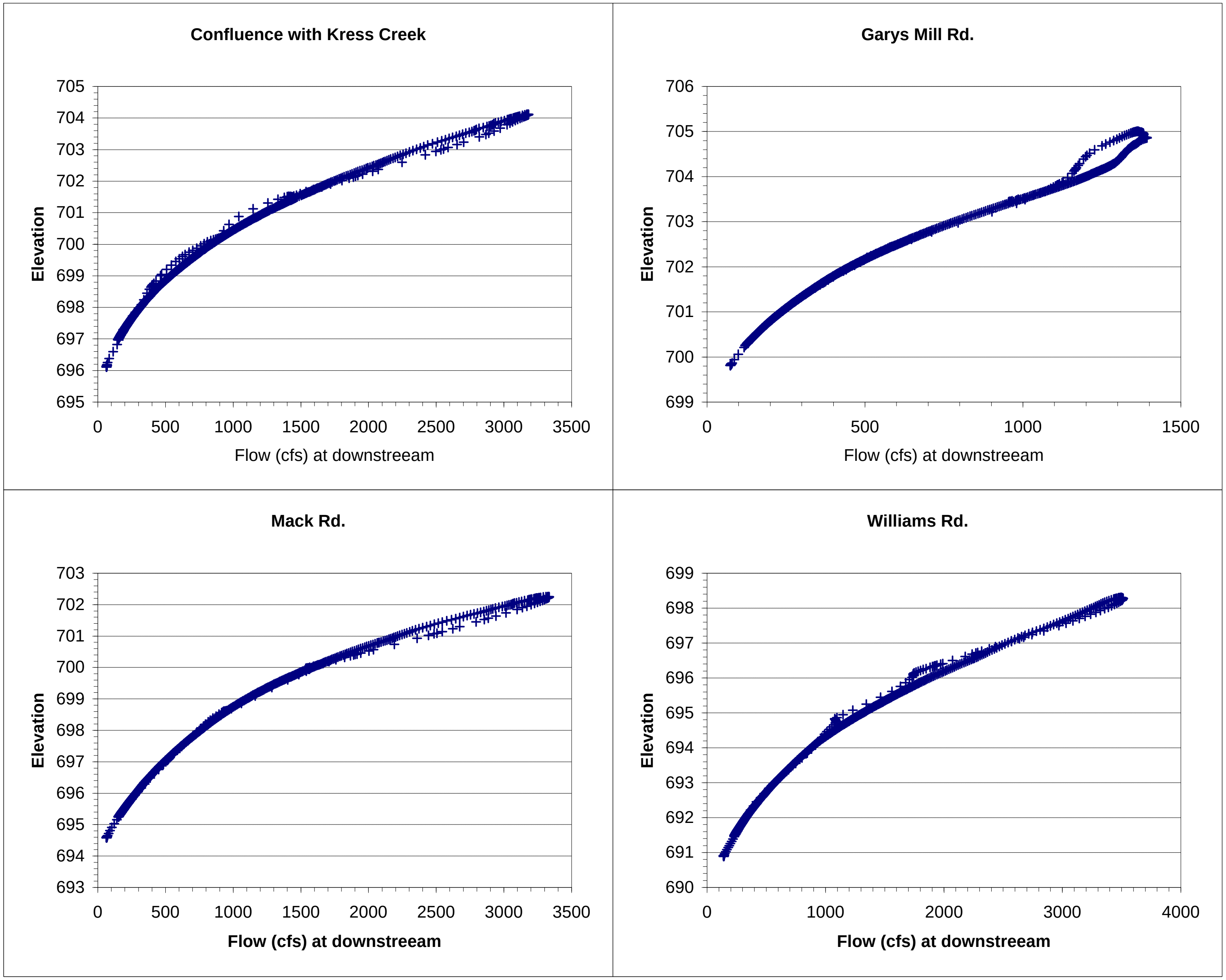


Figure 10. W. Br. DuPage River rating curves computed by FEQ at potential pump by-pass locations.

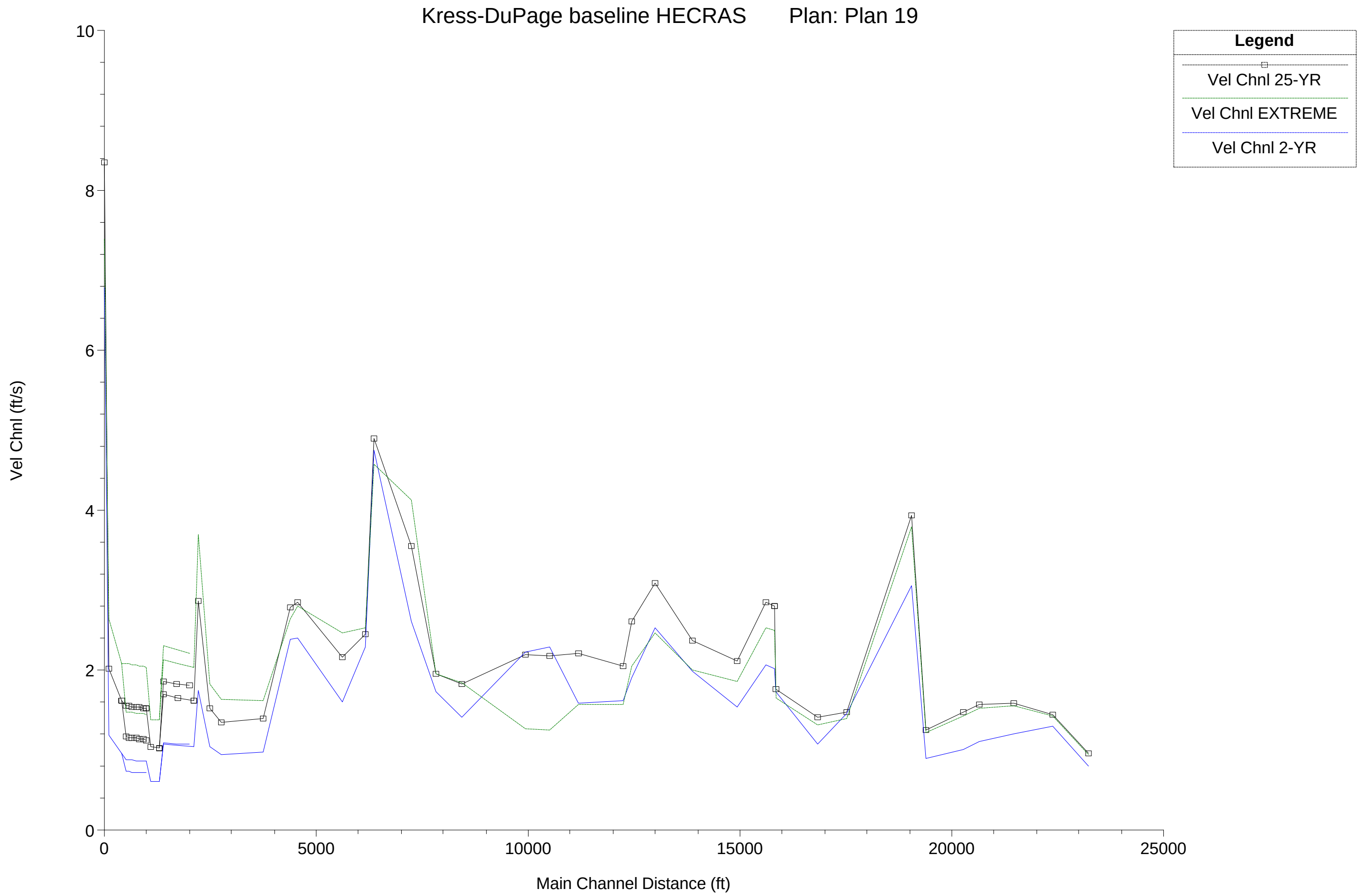


Figure 11. Comparison of downstream velocity profiles in W. Br. DuPage River for 25-year return flow at Warrenville Dam (2,500 cfs) and 4,300 cfs, which is the highest observed flow at the Dam computed by FEQ for the 1996 event.

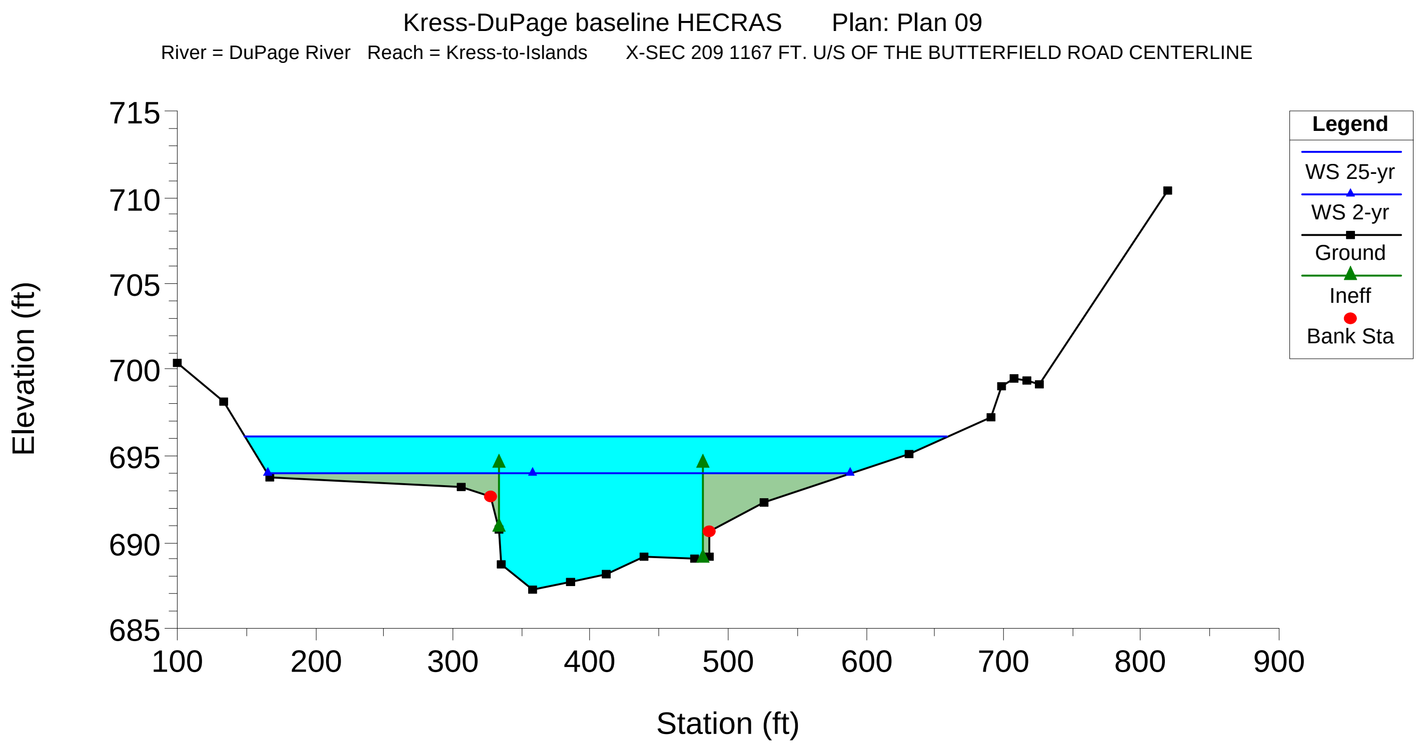


Figure 12. Illustration of sheetpile representation in HEC-RAS to simulate effects on WSE of sheetpile or sandbagging along shorelines for water diversion. The hatched are represents cross-sectional area that cannot accommodate flow unless the sheetpile is overtopped, as shown for the 25-year flow.

Figure 13. Predicted Effects of Bank Sheeting for Water diversion on WSE for 2-yr Flood on W. Br. DuPage River.